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THE EFFECT ON CARIES INCIDENCE OF A SINGLE TOPICAL APPLICATION OF A FLUORIDE SOLUTION TO THE TEETH OF YOUNG ADULT MALES OF A MILITARY POPULATION[1]

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Epidemiological evidence shows that individuals using, throughout life, domestic waters containing small amounts of fluoride experience a relatively low amount of dental caries. Some of the epidemiological aspects of the fluorine-dental caries relationship have been recently reviewed by Dean (1).

In order to test further the inhibitory effects of fluorides on dental caries other avenues of approach are being investigated. Results of studies designed to determine whether or not fluoride solutions applied to the external surfaces of the teeth would decrease their susceptibility to caries attack have been reported (2), (3), (4). While these studies are still in the experimental stage, the results have suggested a beneficial effect. The three studies reported were made on children and multiple applications of fluoride solutions were used during the study period.

The primary purpose of this study was to learn whether or not a single application of a fluoride solution would appreciably lower the incidence of dental caries in young male adults living under military conditions. If multiple applications were necessary to decrease the caries incidence, the value of this prophylaxis would be largely nullified insofar as its use in the armed forces is concerned.[2] The present study was made at the U. S. Coast Guard Academy, New London, Connecticut. All regular Cadets of the 2nd and 3rd classes were included in the study and the period of observation was one year. All Cadets ate in the regular Academy Cadet mess.

METHODS

In September 1942 all Cadets of the 2nd and 3rd classes were given a complete dental examination by a dental officer[3] using the facilities of the Academy Dental Clinic. Bite-wing radiograms were taken of each individual, using 4 posterior and 3 anterior films. Each Cadet filled out a questionnaire showing his place of residence during the first 8 years of life, indicating whether urban or rural. These records were studied and classified as to whether or not the individual was

[1] Presented at the 22nd General Meeting of the International Association for Dental Research, Chicago, March 18–19, 1944 (*J. D. Res.* **23**: 206, 1944, this issue). Received for publication April 4, 1944.

[2] As a public health procedure the value of topical application of fluorides to control dental caries obviously decreases as the number of treatments increases.

[3] All clinical examinations were made by Dental Surgeon E. M. Short.

likely to have used fluoride-containing waters during the formative period of his teeth. The results of this classification were recorded on his examination schedule together with the clinical observations regarding the presence or absence of dental fluorosis. At the time of the first examination, twice during, and once at the end of the study year, saliva samples were collected from each Cadet and *L. acidophilus* counts determined. All counts were made by one of the authors (FAA) and all saliva specimens were collected in the morning prior to brushing of the teeth and eating.

After completing the clinical and bacteriological examinations, the record of each individual was matched with that of another, one record being put into Group A. (control) and the other into Group B. (experimental). In order to make "matched-pairs" of these records the following criteria were given consideration; (a) the number of *L. acidophilus* found present in the saliva, (b) the presence or absence of suggested fluoride exposure during the first 8 years of life as indicated by the clinical examination or by residence history, (c) the past caries experience of the individual taking into account the number of teeth showing fillings, extractions, or untreated lesions, and giving consideration to the extent and location of this caries experience, (d) the age of the individual and his class in the Academy, i.e. 2nd or 3rd. During the process of matching the records the order of precedence of these various criteria was the same as given above. Thus each Cadet in Group A had a partner in Group B who had what might be called a "comparable oral condition."

In order to eliminate the chance of personal bias the dental officer (D. E. S.) applying the fluoride treatments had no knowledge which solution contained fluorides. He was given 2 solutions, (one for spray, the other for topical application) for each group of Cadets. The composition of the different solutions was as follows:[4]

1. Solutions for topical application.

Solution A. (control solution containing sodium chloride)

Sodium chloride	0.26 molar
Acetic acid	1.50 percent
Sodium hydroxide	0.21 percent

This solution had a pH of 4.0 at time of preparation; at completion of treatments the pH was 4.5.

Solution B. (5000 ppm. fluorine as sodium fluoride)

Sodium fluoride	0.26 molar
Acetic acid	1.50 percent

This solution had a pH of 4.0 at time of preparation, at completion of treatments the pH was 4.6.

[4] All solutions were prepared by Senior Biochemist F. J. McClure. Unpublished data from this laboratory indicates that the absorption of fluorine in vitro by powdered enamel is increased by decreasing the pH of the solution.

2. Solutions used in spray bottles.

Solution A. (control solution of sodium chloride)

Sodium chloride..... 0.0526 molar

Solution B. (1000 ppm. fluorine as sodium fluoride)

Sodium fluoride..... 0.0526 molar

The method of applying the above solutions to the teeth was as follows: A complete prophylaxis was given immediately prior to and at the same sitting as the application of the solutions. The prophylaxis consisted of thoroughly scaling the teeth and polishing with pumice which had been mixed with a small amount of the treatment solution. Rubber cups were used on all surfaces of the teeth except the occlusal which were cleaned with brushes. A spray solution, as described above, was used to irrigate the mouth during the prophylaxis and at no time was water used for rinsing. Dental floss was used to clean and work the solution into contact with the proximal surfaces. After the prophylaxis separate quadrants of the mouth were isolated with cotton rolls and the area thoroughly dried with warm air. The treatment solution was then applied liberally with cotton pellets and dried onto the teeth with warm air. This procedure was repeated 3 times on each quadrant in a period of 5 minutes. No other fluoride treatment was given to these Cadets during the study year, however, they received routine dental treatment if they needed it. No additional prophylaxes were given during the one year study period.

In January and July of the study year saliva samples were collected and *L. acidophilus* counts determined as at the start of the study. In September 1943 a second complete dental examination was made by the same examiner using the same equipment as was used at the start of the study. The examiner had no contact with the study except to make the initial and final examinations and the latter was made without reference to the findings of the first examination. The second examination, like the first, was supplemented by the use of bite-wing radiographs, and saliva samples were collected and *L. acidophilus* counts determined.

RESULTS

At the beginning of this study there were 258 Cadets in the 2nd and 3rd classes at the Academy, and their mean age was 19.6 years.[5] During the study year a number of Cadets resigned from the Academy, mostly for scholastic reasons. In September 1943 the study group consisted of only 211 Cadets. In this number there remained only 94 "matched pairs."[6] All comparisons of results between

[5] The specific ages in Sept. 1942 according to last birthday were as follows: 16—17 years old, 41—18 yrs. old, 62—19 yrs. old, 68—20 yrs. old, 45—21 yrs. old, 25—22 yrs. old, 1—23 yrs. old.

[6] There were 23 Cadets in the Academy who were examined both years but whose partners were lost to the study, therefore the findings on these 23 Cadets are not included in the comparisons. Of the 47 Cadets who dropped out of the study 31 were from Group A and 16 were from Group B. It is interesting to note that such a difference in the numbers dropping out of each group would occur less than 3 times in one-hundred trials by chance alone.

1942 and 1943 were made on this latter group. In Table I are given the results in respect to caries experience as observed in the 1942 clinical examination of the 258 Cadets; also the same observations on the 188 Cadets who remained throughout the study as "matched pairs" and constitute the basis of this report. It can

TABLE I

Showing the similarity in 1942 of the dental caries experience in the 258 Cadets originally examined and the 188 Cadets of this group who remained throughout the period of observation

	NO. EXAMINED	FILLED TEETH (PAST DENTAL CARIES)	TEETH WITH UNTREATED CARIES	MISSING TEETH	TOTAL CARIES EXPERIENCE
		Number			
Original group	258	2230	217	125*	2573
Group A (control)	94	823	79	46*	948
Group B (experimental)	94	813	89	47	949
		Number per 100 Cadets			
Original group		864	84	48	997
Group A (control)		876	84	49	1009
Group B (experimental)		865	95	50	1010

* Includes one tooth diagnosed as "extraction indicated."

TABLE II

Results of clinical and radiographic examinations 1 year apart of the 94 "matched" pairs of Cadets in the control (A) and experimental (B) groups

	1942*		1943*		INCREASE	
	Group A	Group B	Group A	Group B	Group A	Group B
No. teeth showing caries experience (clinical exam.)	955	957	1013	1021	58	64
No. teeth showing caries experience (clinical & radiographic	1078	1071	1133	1130	55	59
No. carious surfaces or areas (clinical exam.)	1943	1956	2149	2169	206	213
No. carious surfaces or areas (clinical & radiographic	2295	2274	2500	2446	205	172

* Both groups contain 94 persons.

be seen from these results that the 2 groups of Cadets who remained in the study throughout the year are representative of the original group.

It may be noted that the results shown in Table I are from the clinical examination alone and are meant only to give a general picture of the dental conditions as they were at the start of the study. In order to more accurately measure the gain in carious teeth or surfaces the radiographic findings were added to the above

results. At the same time obvious errors in the clinical examination were edited[7] so that the caries incidence could be determined for each group using the "edited" results for 1942 as a base line and similar results for 1943 for comparison. In Table II are given the results of the 2 examinations both in respect to the number of teeth showing caries experience either by clinical or by clinical plus radiograph examinations and in respect to the caries index.[8]

It has been shown by a number of workers, the Michigan group in particular, that whenever there is a change in the dental caries incidence of individuals the change is associated with an alteration in the *L. acidophilus* count of the saliva (5).

Therefore, if a change has occurred in the dental caries incidence in Group B as compared with Group A., which has not been elucidated by the clinical and radiographic examinations, a comparison of the *L. acidophilus* counts obtained during the year might show such a change. The results of these counts as shown

TABLE III

Numerical distribution of oral L. acidophilus counts on the salivas of the 188 Cadets in the control (A) and experimental (B) groups

NUMBER LACTOBACILLI PER CC. OF SALIVA	SEPT. '42		JAN. '43		JUNE '43		SEPT. '43	
	A.	B.	A.	B.	A.	B.	A.	B.
Negative and <100	18	16	19	19	21	21	14	12
100 to <1000	8	11	8	8	18	13	7	4
1000 to <10,000	21	21	14	20	13	19	13	9
10,000 to <20,000	4	8	4	7	7	12	9	11
20,000 to <40,000	12	10	17	10	11	7	7	13
40,000 to <80,000	12	19	13	17	7	12	16	17
80,000 and over	19	9	19	12	14	7	28	28
Total examined	94	94	94	93	91	91	94	94

in Table III give no indication of any difference in the caries attack rate between the control and treated groups.

DISCUSSION

As stated previously, this study was planned to determine whether a significant reduction in caries incidence in adults of military age could be brought about by a

[7] The editing consisted of correcting the schedule form to take care of obvious errors such as having a tooth show a filling in 1942 and none in 1943 while the radiograph indicated a filling present both years; or the opposite. Also, a tooth which was marked as carious in 1942 was considered carious in 1943 regardless of whether the clinical examination for 1943 had it listed as carious except in those cases where the radiograph showed the opposite to be true. These editing changes were equally distributed in both groups. An idea of the minor influence of these changes can be gained by comparing the total caries experience of the two groups in 1942 as shown in Tables I and II.

[8] The caries index for each individual was calculated according to the method described by Bodecker, (6). It is, essentially, a method to evaluate the number of tooth surfaces or areas attacked by caries.

single application of a fluoride solution. The findings of this study, as shown in Tables II and III, indicate no reduction in caries incidence in the fluoride-treated group (B) either by clinical, radiographic or bacteriological examinations.

Although the results of this experiment are negative in so far as any beneficial effect on dental caries control is concerned, some of the findings deserve further discussion. The method used in this study for selecting the experimental and control groups differs from the usual methods employed. Occasionally when experiments are planned to determine the effect of caries control measures, attempts are made to have the experimental and control groups comparable as to age, sex, and number of teeth showing dental caries experience. Little, if any, attention is paid to factors such as the conditions under which the teeth were formed on the oral environment at the time of the study. Yet it is generally agreed that these conditions do play a role in the etiology of the disease. An attempt has been made in the present study to equalize these known variables by the method used in matching or pairing the experimental and control groups.

The importance of one of these variables can be judged by considering the result of comparing the caries incidence in those individuals who had high *L. acidophilus* counts at the start of the study with those who had low or negative counts. The clinical and radiographic examinations show that the 59 Cadets who had high counts (40,000 and over) at the start of the study developed almost 3 times as many new carious surfaces or areas as did the 53 Cadets with negative or low (<1000) counts; average 2.8 and 1.1 respectively. Had this factor not been taken into consideration at the start of the study and the 2 groups balanced accordingly, one group may have had a disportionate number of individuals with high (or low) counts and the results affected accordingly. A similar circumstance would be the conditions associated with the formation of the teeth. An analysis of the questionnaires submitted at the start of the study shows that in the 188 Cadets of groups A and B 15 gave histories indicating residence in known fluoride areas during the first 8 years of life and 44 gave histories suggesting questionable fluoride exposure.[9] It is logical to assume that such a factor would play an important role in any study on caries incidence, especially when the experiment is planned to determine the effect of topically applied fluoride solutions.

In this study the use of bite-wing radiographs to supplement the clinical examinations has permitted certain observations of interest. Although the radiographic results did increase the number of teeth showing caries experience, this increase occurred equally in the 2 groups. However, in 1943 there were 122 "new" carious teeth found in the 188 Cadets by *clinical* examination. Of these "new" carious teeth, 86 had proximal lesions; 79 of these 86 showed evidence of caries by radiograph in 1942. In other words, 79 of the 86 "new" proximal lesions of caries discovered by clinical examination in 1943 were discernible by radiograph in 1942. This finding indicates that without the aid of radiographs clinical examinations 1 year apart may be inadequate to determine whether or not the initiation of enamel caries has been interrupted. This observation may

[9] A positive diagnosis of dental fluorosis was made clinically in only 3 of these 59 cases, 10 other cases diagnosed as "questionable."

also permit an interpretation of reported results (3, 4) to indicate that topical application of fluorides prevents the progress of caries in the dentin rather than its initiation in the enamel.[10]

Attention may be called to the fact that these Cadets ate at the regular mess consuming the usual excellent diet of a U. S. Government military academy. They also represent a "selected" sample in regard to dental caries susceptibility since most individuals who are highly susceptible would be barred from entrance to the Academy due to an early loss of teeth. In spite of the foregoing, the results of this study (Table II) indicate that the Cadets developed an average of 0.65 "new" carious teeth per person per year. This incidence of dental caries is similar if not greater than the normal expectancy in general population groups of similar age.[11] Such results seemingly give little encouragement to the use of so-called "optimum" diets for the control of dental caries in the general population.

SUMMARY

The results of a study in which a single topical application of fluoride was made to the teeth of Cadets at the U. S. Coast Guard Academy are reported:

1. After a complete dental examination, including radiographs and *L. acidophilus* counts, the Cadets were divided into 2 groups on a "matched pair" basis. Each member of one group had a partner in the other group who had a comparable oral condition in regard to the following: *L. acidophilus* count, fluoride exposure during the first 8 years of life, past caries experience, and age. Following a prophylaxis a sodium fluoride solution containing 5000 ppm. F, was applied to the teeth of one group (experimental) and a sodium chloride solution of equivalent concentration was applied to the teeth of the Cadets in the second group (controls). The period of observation was one year.

2. The observations made by the clinical examinations at the beginning and the end of the study period gave the following results: (a) The Cadets of the control and treated groups developed about the same number of new carious teeth, averaging 0.62 and 0.68 respectively. (b) The 2 groups showed similar gains in the number of new carious surfaces or areas as measured by Bodecker's index; controls averaged 2.2, experimental averaged 2.3.

3. Bacteriological examinations made on the saliva at 4 different times during the study year gave no indication of any change in the distribution of high and low *L. acidophilus* counts occurring in either of the groups.

4. There is no evidence in this study that a single topical application of a fluoride solution to the teeth of young adults as here carried out would result in reduction of dental caries incidence.

The authors gratefully acknowledge the assistance and cooperation rendered by the officers on duty at the U. S. Coast Guard Academy, New London, Connecticut.

[10] It should be noted that results reported by McClure (7) in regard to the post-eruptive addition of fluorine to the dentin of rats' molar teeth would appear to support such an interpretation.

[11] Personal communication from Dr. Henry Klein, from basic data obtained by examinations of 1229 white males, 17–22 years of age inclusive reported in Public Health Reports (8).

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A MEASUREMENT OF DENTAL CARIES PREVALENCE AND TREATMENT SERVICE FOR DECIDUOUS TEETH[1]

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Data on the incidence and prevalence of dental caries in permanent teeth have provided basic information for epidemiologic studies of dental caries and for caries prevention and control. In addition to its use in research, measurement of dental caries incidence and prevalence has become indispensable to the administrator of a children's dental health program. By establishing a base line of the occurrence of caries and by determining the status (fillings vs. neglect) of teeth with a history of decay, the results of a dental health program can be most effectively appraised over a period of years.

A number of systems have been suggested for establishing a quantitative dental caries index. Morelli's "Quantitative Caries Index for Teeth" (1) and Day and Sedgwick's "Caries Index" (2) do not supply adequate information, while Bodecker's "Modified Dental Caries Index" (3) is not easily adapted to large populations. For all general purposes, the method developed by Klein and Palmer (4) based on the determination of decayed (D), missing (M) and filled (F) teeth is sufficiently comprehensive and yet easily applied for computing past and present caries experience in permanent teeth. The latter system is now being used extensively for a variety of purposes.

Knutson (5) suggested a number of important considerations for appraising a dental health program. Actual experience in the promotion of a dental health program for children has shown that DMF data can be used effectively to determine (1) the rate of increase or decrease of caries incidence and prevalence, and (2) changes in the percentage distribution of decayed, missing and filled permanent teeth. For example, if a high percentage of permanent teeth with a history of decay remain untreated or are lost, it naturally follows that a dental health program is ineffective. On the other hand, if the incidence of caries is decreased or if a high percentage of permanent teeth with dental caries experience are properly filled, then a dental health program is accomplishing its purpose.

In developing methods for appraising dental health programs for children consideration should be given to the occurrence and treatment of dental caries in deciduous teeth as well as in permanent teeth. Considerable effort has been devoted in recent years to overcoming an almost universal neglect of deciduous teeth. Adequate dental service for children is one of the most important phases of the dental health program. Thus, it is obvious that a measurement of the occurrence of dental caries and the amount of filling service for deciduous teeth, comparable to that being used for permanent teeth, is highly desirable.

[1] Received for publication April 5, 1944.

It is well known that the DMF system can only be applied to permanent teeth. As was pointed out by Klein and Palmer (4), "an equivalent measurement of the complete caries experience in the deciduous teeth is not possible since a definite decision may not be made as to whether a missing deciduous tooth has or has not been carious. These latter considerations emphasize again that quantitative facts regarding dental caries in children should be presented separately, and in different ways, for the deciduous and permanent dentitions."

In 1943 the American Association of Public Health Dentists (6) adopted a dental examination record form for use in children's programs. The record form was designed to measure the prevalence of dental caries and the ratio of filled to carious teeth in both the deciduous and permanent dentitions. The DMF system was incorporated into the record form for use in connection with permanent teeth. In keeping with Klein and Palmer's admonition that "a measurement of the complete caries experience in deciduous teeth is not possible" the tabulation of deciduous teeth with a history of decay is based on an accounting of past and present caries in deciduous teeth which are present in the mouth at the time of the examination. To eliminate the possibility of confusing the new symbols with the letters DMF, lower case letters "def" are used to indicate decayed deciduous teeth indicated for filling (d), decayed deciduous teeth indicated for extraction (e), and filled deciduous teeth (f).

This system of measuring caries prevalence in deciduous teeth may not meet the requirements of epidemiology and research since in children of some ages a large segment of deciduous teeth with past caries experience have been extracted or exfoliated and, thus, are not counted. However, it has proved to be a valuable adjunct to DMF accounting in appraising dental health programs for children, particularly because it permits a determination of untreated decayed and filled deciduous teeth.

At the present time no term has been adopted to describe the "def" system for measuring dental caries incidence and prevalence in deciduous teeth. It is now proposed that the term *observable dental caries prevalence* be used in connection with the symbol "def" to indicate dental caries experience which can be observed in deciduous teeth present in the mouth at the time of the examination. The observable dental caries prevalence in deciduous teeth is computed by adding the number of decayed deciduous teeth indicated for filling (d), the num- of decayed deciduous teeth indicated for extraction (e) and the number of filled deciduous teeth (f) for each child examined.

An example of the use of def measurement, as compared to DMF, in appraising the dental health program is shown as follows: Table I lists the number of children (white), the def rate, the percent of children with def teeth, and the percentage distribution of decayed and filled teeth with an observable history of decay. Table II lists the same type of information for permanent teeth excepting that the percentage distribution of decay, missing and filled permanent teeth represents all erupted teeth with a history of decay. Data of this character establish sufficiently accurate dental caries prevalence rates as well as a base line of dental service needs and previous dental treatment for a specific group of children.

TABLE I

Number of white children, observable dental caries prevalence rate (def) in deciduous teeth per 100 children, percentage of children with one or more def deciduous teeth, and percentage distribution of decayed and filled deciduous teeth with a caries history, by age.

ITEM	AGE LAST BIRTHDAY							
	6	7	8	9	10	11	12	All Ages
Brentwood, Missouri								
Number of children	72	82	74	65	66	62	61	482
"def" teeth per 100 children	185	264	299	235	136	116	25	187
Percent with "def" teeth	56	79	72	72	50	53	34	61
Percent of "def" teeth decayed, filling indicated (d)	59	59	44	48	34	35	33	49
Percent of "def" teeth decayed, extraction indicated (e)	2	5	13	15	16	11	20	10
Percent of "def" teeth filled (f)	39	36	43	37	50	54	47	41
Clayton, Missouri								
Number of children	134	135	143	127	142	145	144	970
"def" teeth per 100 children	93	179	236	159	113	79	22	125
Percent with "def" teeth	30	56	62	51	36	26	10	38
Percent of "def" teeth decayed, filling indicated (d)	50	46	40	48	23	30	39	40
Percent of "def" teeth decayed, extraction indicated (e)				1	3	6	3	1
Percent of "def" teeth filled (f)	50	54	60	51	74	64	58	59
Kirkwood, Missouri								
Number of children	266	197	228	222	191	208	130	1442
"def" teeth per 100 children	172	259	182	150	104	57	12	142
Percent with "def" teeth	45	65	61	61	49	32	13	48
Percent of "def" teeth decayed, filling indicated (d)	54	55	63	58	49	48	40	56
Percent of "def" teeth decayed, extraction indicated (e)	5	6	10	7	11	10	33	8
Percent of "def" teeth filled (f)	41	39	27	35	40	42	27	36
Valley Park, Missouri								
Number of children	20	115	76	63	40	27	15	356
"def" teeth per 100 children	85	105	111	98	80	78	33	96
Percent with "def" teeth	90	95	96	87	50	15		78
Percent of "def" teeth decayed, filling indicated (d)	82	67	64	44	37	38		57
Percent of "def" teeth, extraction indicated (e)	12	31	33	44	50	48	100	37
Percent of "def" teeth filled (f)	6	2	3	12	13	14		6

The information aids in planning a course of action and serves to appraise results of the dental health program by comparing similar data over a period of years. The data represents statistical treatment of dental examination records of 3250

TABLE II

Number of white children, dental caries experience rate (DMF) in permanent teeth per 100 children, percentage of children with one or more DMF permanent teeth, and percentage distribution of decayed, missing and filled permanent teeth with a caries history, by age.

ITEM	AGE LAST BIRTHDAY							
	6	7	8	9	10	11	12	All Ages
Brentwood, Missouri								
Number of children	72	82	74	65	66	62	61	482
DMF teeth per 100 children	3	15	59	89	98	185	195	86
Percent with DMF teeth	3	12	24	43	44	69	67	35
Percent of DMF teeth decayed, filling indicated (D)	100	75	16	43	29	22	23	28
Percent of DMF teeth missing (M)				2	2	2	1	1
Percent of DMF teeth filled (F)		25	84	55	69	76	76	71
Clayton, Missouri								
Number of children	133	137	137	129	136	153	169	994
DMF teeth per 100 children	0.7	14	62	95	131	182	186	101
Percent with DMF teeth		8	24	39	46	62	38	32
Percent with DMF teeth decayed, filling indicated (D)	100	58	25	16	11	12	10	14
Percent of DMF teeth missing (M)			1		1	1	2	1
Percent of DMF teeth filled (F)		42	74	84	88	87	88	85
Kirkwood, Missouri								
Number of children	266	207	228	206	191	208	130	1436
DMF teeth per 100 children	3	24	73	101	172	179	257	102
Percent with DMF teeth	1	12	28	32	61	61	67	34
Percent of DMF teeth decayed, filling indicated (D)	56	58	32	28	18	18	14	22
Percent of DMF teeth missing (M)	22	4	8	1	4	3	5	4
Percent of DMF teeth filled (F)	22	38	60	71	78	79	81	74
Valley Park, Missouri								
Number of children	9	47	33	36	37	37	21	220
DMF teeth per 100 children	22	77	173	206	265	281	276	126
Percent with DMF teeth	22	40	61	61	81	78	71	62
Percent of DMF teeth decayed, filling indicated (D)	100	100	95	77	69	79	72	80
Percent of DMF teeth missing (M)			4	4	11	5	17	7
Percent of DMF teeth filled (F)			1	19	20	16	11	13

white grade school children in 4 communities in St. Louis County, Missouri. The records of permanent teeth for 118 children were not included in the tabulations because of errors.

Fig. 1 illustrates graphically the percentage distribution of decayed and filled deciduous teeth with an observable history of caries, and the percentage distribution of decayed, missing and filled permanent teeth with a history of decay. It is thus possible to visualize the ratio of filled teeth to untreated carious teeth and to determine present dental service needs as well as future accomplishments.

It is a well known fact that dental and public health facilities are usually inadequate to meet the dental service needs of all children. It seems logical, therefore, to use such resources as are available where the need is the most acute.

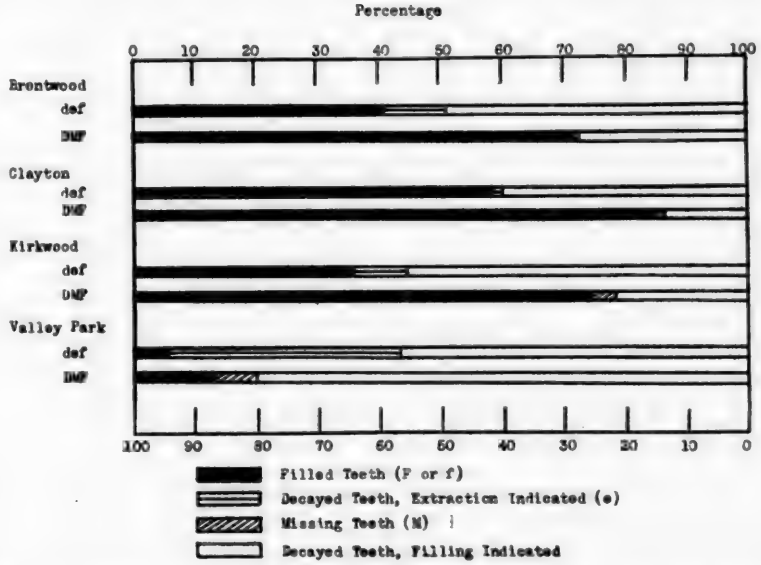

Fig. 1. Percentage distribution of decayed and filled deciduous teeth with observable history of caries, and percentage distribution of decayed, missing and filled permanent teeth with history of caries, for specified groups of Missouri school children.

Fig. 1 reveals that 2 problems exist in connection with the dental health of the 4 groups of school children and that all available resources in health education and dental treatment service should first be directed toward the 2 most important requirements. First it will be noted that in Brentwood, Clayton and Kirkwood more than 70% of the permanent teeth with a history of decay have been filled. (Unpublished data reveals this is the highest percentage of filled teeth of any group of similar age surveyed in Missouri). In Valley Park, on the other hand, only 13% of the permanent teeth with a history of decay have been filled. The same comparative need is evident with respect to decayed deciduous teeth in Valley Park and the children in this community, therefore, require special attention in the organization of a county dental health program.

Fig. 1 further reveals the fact that in all 4 groups of children there is a disparity between the percentage of filled deciduous teeth as compared to the percentage of

filled permanent teeth with a history of decay. This difference, amounting to from approximately 25% to 50%, demonstrates the indifference in and lack of attention for decayed deciduous teeth even for those children who have received exceptionally good service for permanent teeth.

From the viewpoint of public health administration it may not be practical to collect and analyze data (as herein described) of all children every year. Experience has shown, however, that dental service needs vary greatly with different communities and that a base line predicated on adequate data is an important prerequisite for planning an effective dental health program and for appraising whatever procedures are used to prevent and to control dental diseases.

SUMMARY

Measurements of the incidence and prevalence of dental caries provide important data for studies of dental practice problems, for research and for public health administration. Several systems have been suggested for determining the occurrence and distribution of dental caries in the population; the one most commonly used is based on the measure of past and present caries experience of permanent teeth (DMF).

A real need exists for a comparable system of measurement of the occurrence of dental caries and of the amount of filling service for deciduous teeth. The impracticability of employing the DMF system for deciduous teeth is discussed. A method for determining the occurrence of dental caries and the percentage distribution of decayed and filled deciduous teeth, which are present in the mouth, is presented. A new term is proposed to designate dental caries experience which can be observed in deciduous teeth.

Data on the prevalence of dental caries and the amount of filling service for both deciduous and permanent teeth is presented and analyzed as an example of its value in planning and appraising a dental health program for children.

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TWO KINDS OF UNDERMINING ENAMEL CARIES[1]

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LITERATURE

Miller (1) found that after the enamel has been perforated by decay its further destruction proceeds principally from the inner surface. Hodge and McKay (2) reported that the outer layer of the enamel is hardest, the enamel layers most remote from the surface being softest. E. Hinds (3) confirmed that statement and found the same difference in unerupted teeth. He also showed (5) that the more highly calcified enamel is, the greater is its resistance to penetration of ammoniacal silver nitrate. Gottlieb and Stanton demonstrated (6) that homogeneously calcified, transparent enamel acts as a barrier against spreading of caries. Applebaum (7) described how the Retzius lines become more visible in caries and Schour (4) showed that the incremental line, which corresponds to the date of birth is poorly calcified and accentuated (neonatal ring).

Thewlis (8) found a hypercalcified layer on the surface of the enamel, radiographically. Some critics thought at first that this was an artefact but he (9) verified his finding later by checking with a microphotometer. Hollander and Saper (10), using Grenz rays, showed a radiopaque strip persisting on the surface of the enamel over an area of decalcification. Pincus (11) suggested that this effect is due to acidogenic bacterial invasion through the denser layer, increasing in number in the softer layer and thus producing more acid. Appelbaum (12) showed an outer enamel layer remaining intact over a decalcified strip in the enamel in connection with caries. He pointed to the difficulty of explaining how acid penetrating from outside does not attack higher calcified tissue.

Gottlieb (13) expressed the belief that the carious process is characterized only by appearance of yellow pigmentation. He explained the higher resistance of carious enamel to acid action by invading microorganisms which enrich the protein content of the enamel. Enright, Friesell and Tresher (14) pointed to the possibility that organic material from the saliva might produce that effect. Baumgartner (15) and Fleischman (16) found microorganisms in the prism sheaths and G. V. Black (17) illustrated a lamella crowded with microorganisms.

FINDINGS

Fig. 1 shows a mesiodistal section through 3 molars of a young human. The roots of the second molar are not yet completed, and root formation has not yet started at the third molar. All the enamel, even that of the germ of the third

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molar has been dissolved by 5% nitric acid of the histological technique. Only the carious enamel (a) resisted acid action. *Fig. 2* is a higher magnification of the persistant carious enamel of *fig. 1*. The cuticle (a) is detached from the enamel surface. It is interrupted at the place of entrance into the carious cavity (b). The empty cavity in the deeper part might not be entirely a carious cavity. I am not able to state what it contained. The borders of this empty place are formed by necrotic material. The carious process has not affected the dentin

Fig. 1. Decalcified mesio-distal section through 3 lower molars of a young person. (a) enamel persisting in caries. (b) deposit.

Fig. 2. The carious enamel of *fig. 1* in higher magnification. (a) cuticle. (b) entrance to a cavity. (c) carious enamel with accentuated incremental lines. (d) dentin.

Fig. 3. Higher magnification of cavity entrance of *fig. 2*. (a) cavity entrance with necrotic enamel, (b) detached cuticle, (d) carious enamel with persisting prisms, (c) enamel prisms becoming necrotic.

(d), in this section or in the other sections of the series. *Fig. 3* is a higher magnification of one side of the entrance to the cavity of *fig. 2*. We see here the entrance to the cavity (a), the cuticle (b) and the surface enamel (d) showing straight, parallel prisms. The fact that this structure resisted acid action indicates that the organic part of this enamel has been fortified. Towards the cavity there is at one place (c) a transition between prism structure and the surrounding amorphous material, which forms the necrotic lining of the cavity. That indicates that the carious process has progressed farther in the deeper portions of the enamel while the outer layers persisted longer. This specimen did

not show even a trace of yellow pigmentation. It is a decalcified section, having passed through absolute alcohol and ether and having been stained with 2 stains so that it is conceivable that original yellow pigmentation does not show up anymore. However, all other phenomena shown in this series of sections indicate that this is a carious process.

Fig. 4 is part of a decalcified horizontal section, where a piece of carious enamel resisted acid action. That piece showed a distinct yellow pigmentation. It was not bright as in ground sections but resisted all chemicals used in the histological technique. Somewhat oblique to the surface, black lines (a) run approximately

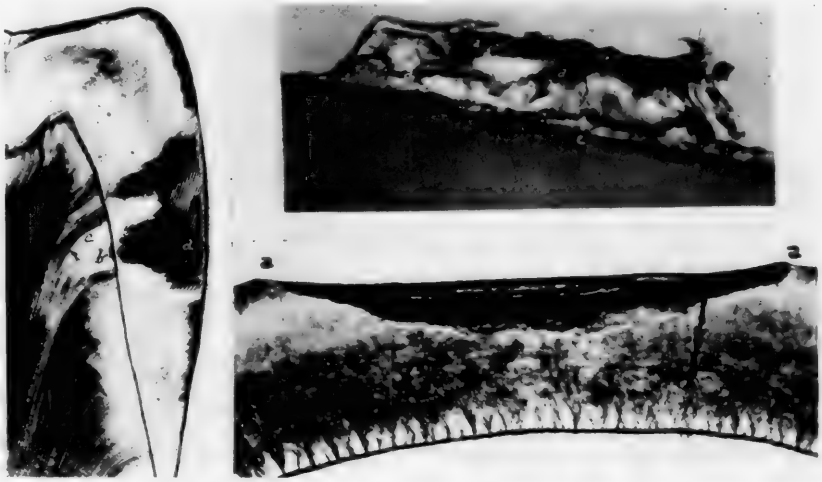

Fig. 4. Decalcified, horizontal section through carious enamel. (a) accentuated incremental lines, (b-c) lamella running from surface into dentin, (d) lamellae connecting different incremental lines.

Fig. 5. Ground section. (a) frontal caries with accentuated incremental lines, (b) yellow pigmented dentin, (c) transparent dentin of first degree.

Fig. 6. Ground section. Worn down contact plane between (a-a), (b) arrested enamel caries limited to that plane.

parallel to each other. Similarity accentuated is the lamella (b–c). At the entrances to the lines (a) there is black, necrotic material and in the area between these lines prism structures are still visible. The 2 lamellae (d) are running from one incremental line to another. The black stain of their common incremental line continues a short distance into the 2 lamellae. The lamella (b) continues into the dentinal part (c) both exhibiting the stage of necrosis. Their discontinuation is probably caused by shrinkage of the dentin.

Fig. 5. shows a mesiodistal ground section through a premolar with an intact, brownish pigmented area. The incremental lines outside the carious area are difficult to be seen but in the area of frontal caries (a) they are accentuated. At the cervical end the accentuation fades out wedgelike. In some places black lines alternate with white ones, in others this pattern disappears, the light lines

becoming dark too. They represent homogenized dark areas. Near and parallel to the surface is a more resistant white strip. The black spot (d) in the dentin at the dentino enamel junction is deeply yellow pigmented. The surrounding light area (c) shows a lighter yellow. It is transparent dentin of first degree, produced by decalcification.

Fig. 6 shows a worn down contact plane between a–a. An apparently arrested enamel caries (b) is limited to the contact plane.

DISCUSSION

Undermining caries can only develop in places where tissues or tissue parts, which have different resistance to the carious process, adjoin. The tissue which offers less resistance is affected more than the neighboring more resistant tissue, thus causing differences in spreading. The borderline between enamel and dentin and the cemento-enamel junction are prone to develop undermining caries. In the homogeneous tissue of the root no undermining caries can develop.

While these two places of predisposition to undermining caries are of clinical importance, the two forms of undermining enamel caries described here are more of theoretical importance. They are supposed to verify again the lines along which caries spreads. Acid attacks calcified tissue readily, while less calcified tissue exhibits greater resistance. In a proteolytic process the tissues react the opposite way. The more a tissue is calcified the more it resists proteolytic action. When the carious process encounters tissues with different degrees of calcification it must be determined whether the process finds more resistance in one or the other of these tissues. In the present investigation of the enamel the process is seen to spread along the less calcified incremental lines and along the lamellae (*fig. 4*). The harder surface layer resists more than the deeper softer layers (*figs. 2* and *5*). That demonstrates that caries of the enamel is not acid action but a proteolytic process.

Caries is characterized by the yellow pigmentation of the affected parts of the tooth which is to be found in all stages of the carious process. It is probably produced by microorganisms. Acid usually accompanies the carious process, but not as acid produced on the tooth surface by fermentation, but produced at the place of action by microorganisms. Thus it is seen that both components of the carious process are products of invasion of microorganisms. These proceed along passable protein pathways. A tangible obstacle against such an invasion is higher, homogeneous calcification of the tissue. Thus we can understand undermining enamel caries. The fact that the deeper layers of the enamel are softer (less calcified) than the superficial ones explains why the inner layers of enamel are less resistant to spreading of the carious process. We may call that result *diffuse undermining enamel caries*, having a small entrance at the hard surface and an extended cavity beneath (*fig. 2*). In the superficial layer the prismatic structure can still be recognized while the deeper layer is already in the final stage of necrosis (*fig. 3*). The yellow pigmentation was present probably in both places but was removed by the chemicals used in the histological technique. Sometimes yellow pigmentation is clearly visible in carious enamel remnants

of decalcified sections (*fig. 4*). While the ground section shows a brighter yellow in the dentin, the decalcified section seldom shows a trace of yellow pigmentation in clearly affected dentin. Yellow pigmentation can only be studied in untreated ground sections. Impregnation of teeth with silver nitrate, previous to section, alters the yellow pigmentation often considerably.

Sometimes pigmentation of worn down contact planes is found limited to the contact plane, while the surrounding enamel is not affected (*fig. 6*). This may be due partly to the fact that the harder surface is worn down and less resistant parts are exposed. Such a frontal caries may be arrested before reaching the dentin, if further progress is blocked.

Retzius incremental lines are known to be formed by alternating of lighter and darker strips. Enamel layers formed successively along these lines sometimes alternate in the degree of calcification. The darker lines are the poorer calcified strips. The neonatal line is a strongly accentuated incremental line of poor calcification. The less calcified strips are affected by caries earlier (black lines) while the more calcified between resist invasion longer and remain light. If the light strips are finally affected too a homogeneous black area results (*fig. 5*). In such black places individual prisms can no longer be differentiated. An amorphous material is present and it might be justified to call it necrotic, the tissue having lost its histological characters. A clinical cavity develops if a macroscopical part of the tooth substance becomes necrotic and is removed by food or saliva or if it is removed by the explorer. As long as microscopical parts become necrotic leaving between intact tissue the whole area is kept in shape and a cavity cannot be detected clinically. Such small necrotic areas surrounded by healthy tooth structures might be called microscopic cavities. *Fig. 4*, showing these conditions in a decalcified section, illustrates that more clearly.

After complete decalcification signs of different degrees of calcification disappear and healthy enamel is nearly entirely dissolved. If enamel remains after decalcification, it indicates that more organic matter was in this part, increasing the resistance to acid. The suggestion that organic material from the saliva has infiltrated the decalcified enamel thus making it more resistant to acid, has been offered. The other suggestion, made by the writer, is that the bodies of the invading microorganisms enrich the protein content of the affected enamel. Microorganisms have been demonstrated in the prism sheaths as well as in the lamellae. The transverse striation of the enamel prisms is more accentuated in carious enamel than in transverse striation produced experimentally by acid action on extracted teeth. The accentuation remains also in decalcified sections of carious enamel. *Fig. 4* shows a piece of carious enamel in a decalcified section. The incremental lines (a) as well as the lamella (b–c) are represented by black strips of amorphous nature where one cannot see the individual prisms as in the enamel between. We cannot find a better explanation than that these are the invasion roads of the microorganisms where the result of their action has progressed to the final end of necrosis, while the enamel between is only enriched by protein resulting in increased resistance to acid action. These prisms show,

under higher magnification, dislocation and no prism sheaths between. Observations on other similar specimens suggest that the sheaths have been digested and thus disappeared. This kind of microscopic necrotic cavities may be called *caries spreading along the incremental lines.*

Here we see again that caries spreads along the organic roads and that the more calcified parts show more resistance to the process. That is only possible if the process is proteolytic. Acid attacks only calcified tissue and leaves the organic parts intact. The whole technique of investigating histologically calcified tissues rests on that fact. Experiments on extracted teeth have shown that the results of silver nitrate impregnation resemble quite the pictures of incipient enamel caries. Acid action produces some shifts in calcium salts which we find accompanying caries, but cannot produce pictures resembling caries. It leaves the spreading roads of the carious process intact.

In grenz ray examination of ground sections it has been found that the decalcification in frontal caries avoids the outer harder enamel layer. It is known that acid does not consider higher calcification as a barrier. On the other hand the presence of microorganisms does not show up in the x-ray. The microorganisms produce apparently small quantities of acid which act only in the place of production. The acid producing group, probably in small numbers, comes to the dentino enamel junction. Not much acid action can be seen in the crossed enamel while there is sometimes considerable shrinkage to be observed on the dentin. The microorganisms seem to find better living conditions at the dentino enamel junction, multiply here and produce more acid. Thus undermining acid action in the dentin develops. The same seems to apply to the enamel. The harder outer surface is crossed only by a small group of acid producing microorganisms. As soon as they reach the deeper layers of the enamel, which are less calcified they grow in number and produce more acid. Its result shows up more than the action of the smaller amount of acid in the superficial part.

It might be emphasized again, that acid action on enamel accompanies the carious process but does not represent it. Caries is characterized only by yellow pigmentation.

SUMMARY

1. Caries spreads in the enamel along the less calcified lines and develops faster in less calcified areas.

2. The harder superficial layer of the enamel resists caries more than the softer deeper layers.

3. The alternating, more and less calcified incremental layers of Retzius differ also in their resistance to caries. The darker, less calcified layers are more readily invaded.

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THE RELATIONSHIP OF THE EPITHELIAL ATTACHMENT TO THE ADJACENT FIBERS OF THE PERIODONTAL MEMBRANE[1]

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A fundamental process pertaining to the formation of the pathologic gingival crevice is the apical proliferation of the epithelial attachment alongside the cementum of the tooth. The cause of this proliferation is still questionable, and the exact conditions which increase or decrease its rate are unknown. The purpose of this report is to illustrate the relationship of the epithelial proliferation alongside the cementum to the adjacent principal fibers of the periodontal membrane and to demonstrate that this epithelial proliferation is dependent upon a loss of attachment of these fibers.

PHYSIOLOGY OF THE EPITHELIAL ATTACHMENT

The epithelial attachment may be described as that epithelium which is in organic connection with the tooth surface. Gottlieb and Orban (1) have demonstrated that the epithelial attachment is first seen on the enamel, and, as the tooth erupts, it proliferates alongside the tooth surface. This proliferation continues throughout life; it varies in different teeth, at different ages and in different individuals. Gottlieb and Orban have correlated this proliferation with the continuous passive eruption of the teeth.

While the apical proliferation of the epithelial attachment is going on, atrophy of the gingival crest takes place and detachment of the epithelium from the tooth surface occurs, thus forming the crevice. The depth of the gingival crevice, therefore, is dependent upon the rate of proliferation of the epithelium alongside the cementum, the rate of atrophy of the gingival crest, and the degree of detachment of the epithelium from the tooth surface. If these 3 processes are in balance, then the depth of the gingival crevice remains constant although the crevice shifts apically. However, if this apical proliferation of the epithelial attachment should proceed at a faster rate than the other 2 processes, a deep gingival crevice results. This also occurs if the gingiva becomes inflamed and swollen.

HISTOLOGIC STUDY

Five photomicrographs are presented illustrating the importance of the periodontal fibers in blocking epithelial proliferation alongside the tooth surface.

[1] Received for publication April 3, 1944.

[2] Now Lieutenant Dental Corps, Secretary and Pathologist to the Dental & Oral Pathology Registry, Army Institute of Pathology, Army Medical Museum.

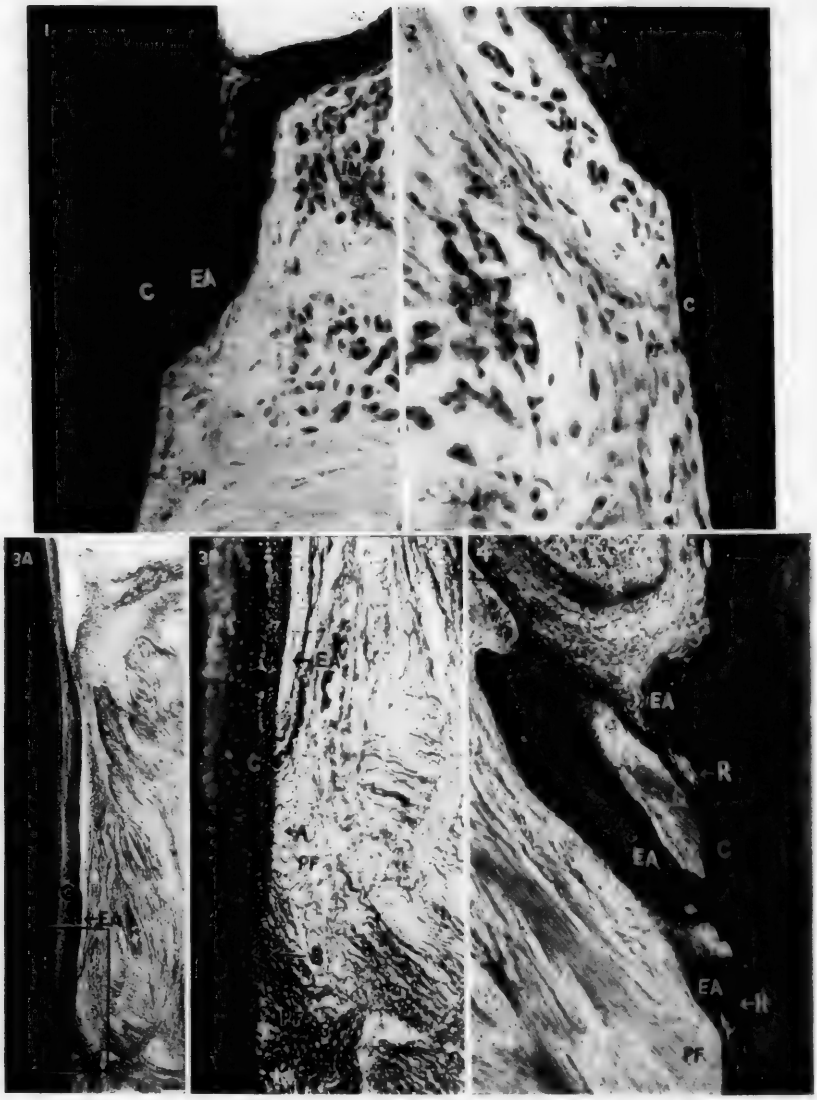

Fig. 1. Photomicrograph showing epithelial attachment on cementum with gingival crevice of minimal depth. Epithelium lies in direct contact with periodontal fibers with no space for epithelial proliferation. C, cementum; EA, epithelial attachment; PM, periodontal membrane; IN, inflammatory cells; Orig. Mag. ×575; hematoxylin and eosin stain.

Fig. 2. Photomicrograph showing similar region as *fig. 1* where, however, there is space between epithelial attachment and periodontal fibers which would facilitate proliferation to point A. C, cementum; EA, epithelial attachment; PF, periodontal fibers; IN, inflammatory cells; Orig. Mag. ×680; hematoxylin & eosin stain.

Fig. 3A. Photomicrograph of a relatively deep gingival crevice. C, cementum; EA, epithelial attachment; Orig. Mag. ×150; Wilder's silver impregnation.

Fig. 3B. High power photomicrograph of blocked area in *fig. 3A*. At A, fibers are small and widely spaced. Swollen fibers are evident above and to right; fibers are degenerative. At B, fibers of normal size and arrangement are seen. EA, epithelial attachment; C, cementum; PF, periodontal fibers; Orig. Mag. ×505; Wilder's silver impregnation.

Fig. 4. Photomicrograph showing epithelial proliferation over unrepaired areas of resorbed cementum. C, cementum; R, resorption of cementum; EA, epithelial attachment; PF, periodontal fibers; Orig. Mag. ×200; hematoxylin and eosin stain.

Fig. 1 is the mesial epithelial attachment of a maxillary first premolar of a 45 year old man. It shows the attachment in direct contact with the connective tissue fibers which make impossible further proliferation. The rate of detachment appears minimal and the crevice is practically of no depth. *Fig. 2* is a photomicrograph of a section of the distal epithelial attachment of a maxillary second premolar of a 52 year old woman. The epithelial attachment (EA) is seen proliferating alongside the cementum; between it and the connective tissue fibers of the periodontal membrane (PF) is an area composed of very loose connective tissue in which an inflammatory infiltrate is seen. Thus a pathway is open for the epithelial attachment to proceed to the point A.

Additional evidence is seen in *Figs. 3A* and *B*, which are photomicrographs of a section of the distal marginal periodontal structures of the maxillary first premolar of a 35-year-old man. The section is stained by the Wilder reticulum method[3] and demonstrates a crevice several millimeters in depth. The attachment of the fibers of the periodontal membrane can be seen clearly. The high power photomicrograph, *fig. 3B*, shows the epithelial attachment at EA and the periodontal fibers attached to the cementum beneath it. The fibers are widely spaced (A). For the most part the fibers can be followed for only a short distance and in the area at A a blotchy material is seen which appears to have resulted from the disintegration of previously intact collagen fibers. At B the fibers are closely packed, and are of normal thickness and appearance. Thus epithelial proliferation through the zone of fiber degeneration up to the normal fibers at B could readily occur.

If the above interpretation is correct, then resorption of cementum at the border of the epithelial attachment should allow for immediate epithelial proliferation and thus shift the attachment towards the apex. *Fig. 4* which is a photomicrograph of the mesial epithelial attachment of a maxillary first incisor of a 52 year old man, shows epithelial proliferation over unrepaired areas of cemental resorption. It is evident that once the barrier was removed, epithelial proliferation took place.

Repaired cemental defects at the borderline of the epithelial attachment are also frequently seen. This is interpreted as follows: If resorption of the cementum occurs at the border of the epithelial attachment, either cemental repair can take place or epithelium can proliferate over the area. Thus, there is a race between the 2 processes, and that which is faster, wins.

SUMMARY

A study of the marginal periodontal structures of jaws obtained at autopsy has shown that apical proliferation of the epithelial attachment is dependent upon the maintenance of the insertion of the principal fibers of the periodontal membrane which lie in apposition to the epithelium. Epithelial proliferation can take place only through the destruction of these connective tissue fibers.

[3] Wilder, H. C., An improved technique for Silver Impregnation of Reticulum Fibers. *Am. J. Path.*, **11**: 817, 1935.

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3. Orban, B., Contribution to the knowledge of physiological processes in the periodontium, *J. A. D. A.*, **16:** 405, 1929.
4. Orban, B., and Mueller, E., The gingival crevice, *J. A. D. A.*, **16:** 1206, 1929.

INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

Proceedings of the Twenty-Second General Meeting[1]

Drake Hotel, Chicago, Ill.

March 18 and 19, 1944

Compiled by HAMILTON B. G. ROBINSON, *Editor*[2]

Washington University, St. Louis, Mo.

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I. Address of Retiring President

Philip Jay, D.D.S., Sc.D., School of Dentistry, University of Michigan, Ann Arbor, Mich.

It was with considerable apprehension that I assumed the presidency of this organization. Now that it is all over, the experience has been enlightening and most pleasant.

A year ago in my inaugural remarks I urged that the submission of items for the oral program of the annual meeting should be made earlier than has been the custom. Early submission would allow ample time for their study by the program committee and the advisors to the program committee. This, in turn,

[1] The sessions of the International Association for Dental Research preceded, by agreement, the Annual Meeting of the American Association for Dental Schools, in the same hotel, March 20–22. The members of each body were welcome at, and participated in, the sessions of both Associations. The annual informal dinner, served to 132 members and guests, preceded the concluding session on the evening of March 19. This dinner and the concluding session were held jointly with Omicron Kappa Upsilon and Robert E. Blackwell, president of Omicron Kappa Upsilon, and Philip Jay presided.

[2] The General Secretary of the Association, E. H. Hatton, has rendered invaluable assistance to the Editor of the Association in preparing these proceedings.

would serve to create a program of maximum interest and logical arrangement. If current expressions of satisfaction and appreciation with respect to this year's program are dependable, the method has worked out very well and I hope it will be continued in the future. A further advantage has been gained. For the first time at a general meeting abstracts of all the items on the program have been supplied on mimeographed sheets to those attending the meeting.

It is a matter of no little satisfaction to the officers and especially to the speaker that this year's activities and deliberations have been characterized by earnestness, good feeling and eagerness to foster all proposals for the welfare of the Association. This is not to be construed as attainment of perfection. Indeed there are still many areas in which there is a great need for improvement. There is still too much confusion in the collection of dues and subscriptions to the JOURNAL. It is and has been my belief that collection of all obligations to the Association should be made from a central office and I have made this suggestion to the Council. On this account it is to be hoped that the proposals adopted tentatively this afternoon will have the hearty support of all members and officers.

For some time I have been convinced that this Association has missed an opportunity or rather has failed to assume a responsibility to extend the boundaries of its activity. There was and still is a great need for an agency to assist in the solution of problems of a general nature in the area of dental research. Such an agency must be general, representative and of such caliber and integrity as to warrant the support and confidence of all who would be inclined to seek its services. There is already a call for such an authority as the officers and the Council have been approached repeatedly for advice and services quite definitely beyond their resources. The members of this Association have a first hand acquaintance with dental research, with its objectives, with its accomplishments and with the obstacles which hinder and impede progress. They should be able to establish an agency which beginning modestly could extend its activities and influence as it gained experience, know-how and a reputation for successful attainment.

As you already know the council's suggestion that the incoming president be empowered to appoint an advisory research council was favorably acted upon at this afternoon executive session. I am, of course, highly gratified by this action and I hope that the members of this Association will not hesitate to bring their problems before this body. We have all become highly specialized and interdependent. The kind of council that I have in mind will make possible an interchange of facilities between laboratories so that all important projects may be explored to the fullest.

This year, in spite of War conditions, has gone smoothly for the Association. Situations that a year ago promised very serious consequences have been corrected or are in the process of being corrected and that without any sacrifice of the highest standards of principle or professional ethics. There seems to be no question but that the officers, the Council, the Board of Editors and the Trustees have had but one broad objective in mind, namely the welfare of the

Association. This spirit of happy and generous co-operation in all activities for the good of the Association is the best legacy that I can bequeath to my successor in office. I can ask for him nothing better than the support and co-operation I have had. May I express my full appreciation of the willing co-operation of all those who participated in the activities of this meeting for their unselfish assistance to make it one of the best.

II. Induction of Active Officers and Introduction of the New President

Thomas J. Hill, D.D.S., Institute of Pathology, Western Reserve University, Cleveland, Ohio

Dr. Hill called up the newly elected officers to the speakers platform, presented them to the audience, inducted them into their various offices and took from them a pledge to serve the Association faithfully during their term of office or until the time that their successors had been chosen.

He then presented the newly elected president, H. Trendley Dean, Senior Surgeon, United States Public Health Service. He complimented Dr. Dean on his life long service in the fields of epidemiology and prevention, both activities that represent true pioneering and the breaking of new ground. Such a form of service is without doubt to become much more common in the near future as more emphasis is placed on the phase of prevention in dentistry. Dr. Dean deserves very great credit for his noteworthy accomplishments in this field, a successful experience, that will without doubt encourage others to follow his example. Just at this time it is particularly fitting and particularly important that the presidency of this Association has been assigned to Dr. Dean, and the Association is to be congratulated for its choice.

III. Inaugural Address

H. Trendley Dean, National Institute of Health, Bethesda, Md.

In accepting the presidency of our Association I am deeply appreciative of the high honor that you have bestowed upon me. Annual installations of new general officers customarily call for pledges of firm resolve to further the interests of the Association and the purpose for which it was founded. Affirmations of this nature seemingly have little or no place in an Association such as ours. Devotion to science and fidelity to a scientific organization are not obligations of a twelve-month; ardor and spirit are not qualities subject to calendar measurement.

At each annual investiture, however, we should pause for a moment and turn back for strength and inspiration to the founders of this Association and renew the ancient pledge of idealism. The courage and vision of those who bore the burden a quarter of a century ago during the founding days of the Association and the Journal are still too well known to need reiteration. The foundation was well laid, built by them with the stones of clear thinking and mortared with an unquenchable idealism for the future of dental research. This vision and

faith constitutes the most priceless heritage of the Association. We pledge our trust that it shall not pass away.

No other American profession occupies such an unchallenged position of world leadership as does American dentistry. It stands out preeminent in its field. For many years, however, this leadership rested largely upon mechanical excellence rather than upon contributions to the physical or biological sciences. All too often the world-wide acclaim accorded American dentistry meant merely a recognition of a high degree of mechanical skill and ingenuity. During the past generation, particularly during the last decade, notable changes have occurred. While clinging fast to and at the same time improving those services which gave it world leadership, American dentistry is again on the march. A profession is being built on the sound basis of scientific investigation. Moreover, and most important of all, the activities are conducted oftentimes by men trained in dentistry working either individually or in close collaboration with others in the co-ordinate fields of physics, chemistry, biostatistics, anatomy, physiology, pathology and bacteriology. While our debt is deep to those in the co-ordinate fields who in the past have done so much to raise the standard of dental research and while we look to them hopefully for even greater contributions in the future, we must emphatically insist that dentists themselves personally contribute their proportionate share in the field of fundamental research. Acceptance of dentistry by science rests obviously on the caliber of the work contributed by members of the dental profession.

Those of us who feel at times that our progress in research is relatively slow will be encouraged by comparing the dental literature of today with that of twenty-five years ago. Nowhere does the transition from mechanical technics to science stand out more sharply. The repercussions of this movement now reach far down into the general practice of dentistry and as the movement continues to gain momentum and to move forward, it is no surprise to find the International Association for Dental Research still out in front spearheading the advance column.

Let us not tarry too long over past accomplishments lest we lose ourselves in the enervating morass of complacency. That is not the way of science. Men and women entering the scientific lists forever doom themselves to disappointment, without despair; failure, without humiliation. Their missions are never wholly fulfilled; their objectives are never wholly reached; their goals are never wholly attained. Such are the rules of the game for those who would joust with Nature's secrets.

Only to those with a key particularly fitted to unlock the treasure does Nature reveal its secret. And even in these rarest of instances where the right key is found the joy is short lived: the elation of victory finds itself immediately tempered by the sight of an unfolding vista of as yet unsolved problems lying beyond the conquest of the moment. During a lifetime a few scientists may gain and consolidate some immediate objective: they never experience a complete victory for they have elected to pit themselves against an opponent that never surrenders unconditionally.

On an occasion such as this there is a natural tendency to drift into an encomium on the recent progress in dental caries research. Flattering as that may be to our collective ego, let us put the thought aside and turn back the pages of history on an oral disease that has sturdily stood its ground and defied the French military surgeons of the 19th century and the dental surgeons of the present century. During recent years there has been a growing conviction among some workers that the causal relationship of the organisms—termed in the older literature fusiform bacillus and the spirillum of Vincent—to ulcerative stomatitis still awaits adequate demonstration. The question of its communicability is once more being considered. There is a healthy growing skepticism that some aspects of this disease lack the scientific security uncritically accepted a few years ago.

With the advent of the bacteriological era sixty years ago, epidemiology was swept off its feet. It was no longer fashionable to study disease as something involving People and Places, Times and Seasons, Air and Water, or Food and Trace Elements. A disease was in danger of losing its respectability if it was not quickly joined in marriage with its consort, A Causal Organism. Fortunately, most of the marriages held; they begot a family of vociferous but sturdy public-health-control children and lived happily ever afterwards. In the rush, however, to the laboratory altar, a few diseases, such as psittacosis and hog cholera, were hurriedly united in marriage to their associated organism. The resultant tragedy and divorce need not concern us here.

The union of ulcerative stomatitis and its hyphenated mate, fusiformis-spirochete Vincenti, was recorded in the Bureau of Scientific Statistics back in 1896. Since then they have consorted together, if not in complete happiness, at least without too much questioning by the curious. In this critical age, however, more and more quizzical eyes are being turned in the direction of this union. Will this proletariat disease, known at present for its nuisance value rather than mortality interest, be expelled from the select Family of Bacteriological Diseases and forced to wander in the tangled jungle of abnormal physiology, nutrition, and mal-hygiene? The answer, of course, lies somewhere in the future.

In transitional periods in the history of a disease when the text book dicta are being seriously questioned and the newer knowledge is far from complete or conclusive, it is profitable to leave our own little sphere of activity and reexamine the epidemiological history of the disease through the wide perspective of a century or more of observation. As Crookshank has said, it is an "empirical fact that epidemiological happenings are not disorderly, but (when looked at from a wide angle) a part of an organized process." Some enlightenment may come from a study of the natural periods in the epidemiological series of a disease.

Because of continual refinement in technical methods recourse to earlier literature in many branches of science serves little purpose than to satisfy curiosity. Epidemiology, being the natural history of a disease, is a notable exception. The gift to observe accurately a disease in a population, the patience to record minutely these observations, the caution to interpret wisely the various

connected environmental circumstances and conditions, and a talent to arrange such findings in a logical order for inductive analysis, are faculties not limited to a particular generation or place. The 19th century studies of Budd, Snow, and Panum have withstood the closest of present day scientific scrutiny; so well in fact that they are used as teaching classics to guide epidemiological workers of the future. The art of sound reasoning is not a monopoly of the living.

One does not travel very far into the 19th century literature on ulcerative stomatitis until he meets with Jules Bergeron.[3] Despite the considerable literature, largely descriptive epidemiology by military or naval surgeons, the figure of Bergeron overshadows all others. His description of the characteristics of the numerous outbreaks, the acuteness of the observations, the reasoned analysis, and the care given to differential diagnosis, all stamp him as a worker who pursued his investigations in a meticulous manner. Bergeron's observations and interest in the syndrome of ulcerative stomatitis apparently extended over a considerable expanse of time—about 30 years. A book in 1859 marks the early period; an extensive 71-page review in 1883, the end. Time limitations naturally preclude any discussion of Bergeron's work; two points of epidemiological interest, however, can not be passed over. First, ulcerative stomatitis was apparently more prevalent then than now; and secondly, increased prevalence generally was observed between April and December with the sharp epidemic outbreaks occurring consistently in the spring.

In the review of 1883 there are a few pages devoted to a subject of such general scientific interest that I am going to refer briefly to them. It has always been the general impression that the bacteriological history of ulcerative stomatitis dates back to Plaut in 1894 and Vincent in 1896. Bergeron's review would indicate that serious thought and work had been given to the bacteriological aspects of ulcerative stomatitis sometime prior to 1883.

While on the basis of epidemiological experience, Bergeron considered the disease communicable, nevertheless he felt that certain predisposing factors, such as nutrition, fatigue, and the peculiar conditions of military or institutional life, seemed almost essential for the development of the disease. He reasoned that had he been able to transmit this disease to healthy individuals by inoculation the contagious aspects of the disease might be assumed. Human experiments, however, conducted by himself and others had all given negative results. He then turned to search for a specific agent and consulted with Pasteur. In the laboratory of *l'Ecole normale* Pasteur examined material from a case of ulcerative stomatitis and was impressed with the large number of spirilla present. Rabbits inoculated with cultures prepared by Pasteur were, according to Bergeron, negative.

Bergeron then began a study in his own laboratory with Netter, one of his internes whom he describes as very expert in culturing bacteria and in microscopic research. [Bergeron's judgment respecting human qualities was evi-

[3] Bergeron, J.: Stomatites. *Dictionnaire Encyclopédique des Sciences Médicales.* Ste-Sue, *91:* (vol. 12 of 3rd series) 146–216, Paris, 1883.

dently as keen as in epidemiological matters; the expert young interne was none other than Arnold Netter, afterwards to become one of France's foremost bacteriologists.] Bergeron then records how Netter was unable to grow the spirillum in neutral chicken bouillon but was successful with ascitic fluid and defibrinated liquid from a pleurisy case. Animal experiments again gave negative results. The fact, however, that they, like other workers whom they mention, also found the spirillum in healthy mouths made them hesitate to assign to it an active role in the pathogenesis of ulcerative stomatitis; an opinion, Bergeron states, also concurred in by Pasteur.

In conclusion permit me to quote a single paragraph from another source of that period:

"There are few diseases that seem to be more favorably placed for the study of their etiology than stomatitis ulcerosa, by reason of its limited diffusion within certain narrow areas and among certain classes of individuals, a limitation which promises to throw a clear light upon the real factors in the pathogenesis. Still the inquiry, thoroughgoing although it has been, has led to hardly anything but a somewhat exact knowledge of certain predisposing causes. And if we would fill up the gaps that remain in the etiology with something better than empty words or unproved hypotheses, we shall have to take Bergeron's attitude of thirty years ago, [apparently refers to Bergeron's 1859 work; writer seemingly unfamiliar with the 1883 review] and look to the future for a solution of the problem, notwithstanding the large amount of experience that has been added between then and now."

These words were recorded by Hirsch[4] in 1886. Not too much editing would be required to fit the same words to the situation sixty years later. Has progress during this interval been such as to fill us with professional elation, or, are we completing a sixty year circle with the problem about where Bergeron left it in 1883? Have we spent most of this interval waging a war of guerrilla therapeusis against a group of organisms while the factor responsible for the proliferation of these organisms in the oral cavity remained largely ignored?

In 1944, as in 1886, we are looking to the future for a solution but with the additional knowledge that ulcerative stomatitis may be a rather complex syndrome. It is well, therefore, for us to be on our guard against close adherence to one generally accepted, and one alone, concept of etiology and therapeusis. A seductive concentration of this nature can easily develop into a professional insulator for quickly deflecting and grounding any interrogatory impulses arising from either study of the epidemiology of the disease, or experimental findings inconsistent with contemporaneous belief.

In closing, there is one thought respecting the future of dental research to which I would like to refer. Many dental colleges have neglected the opportunity of bringing the *research spirit* to the dental students. More dental research should be carried on in the dental colleges themselves. Faculty members should be given more opportunity and facilities for carrying on such work. The dental students would thus be brought into contact with research work

[4] Hirsch, A.: *Handbook of Geographical and Historical Pathology.* 3 vol. translated from the 2nd edition by Charles Creighton, M.D., London (The New Sydenham Society; 1883, 1885, and 1886), ref. p. 261 in vol. 3).

actually done in the dental college by their teachers and would in consequence be afforded the opportunity of learning at first hand the influence and importance of research work upon the future of their profession. Students particularly fitted might be stimulated to choose research as a life work. In this way we might begin the foundation for having the future dental research, particularly that relating to the fundamental sciences, carried out by those who have also early training and experience in dentistry itself. The professional status of dentistry rests on the quality of the research work contributed by its own members.

IV. Index of Participants, and Sequence Numerals of Corresponding Abstracts

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V. First Session: Morning; March 18; Abstracts 1–9

1. Minute anatomy of the soft palate from the view point of denture prosthesis. *Elbert C. Pendleton, D.D.S., M.D.S., Foundation for Dental Research of the Chicago College of Dental Surgery, Chicago, Ill.* Serial histologic sections were prepared from 4 edentulous human upper jaws. Sections were made in sagittal plane to include residual ridge, hard and soft palate with their associ-

ated tissues. Jaws were divided at anatomical landmarks that material could be coordinated with the clinical problem. Measurements, with aid of microscope, were made from posterior border of hard palate to attachment of palatine muscles at palatine aponeurosis. From these dimensions line was drawn on photograph of edentulous maxilla to indicate line of muscle attachment. It is convoluted line with curves opposing those of posterior border of hard palate. It was concluded that the uvulae and palatopharyngeous muscles influence development of posterior border of prosthetic denture *directly*, while the palatoglossus, tensor paliti and internal pterygoid *remotely* affected development of prosthesis by virtue of their tendons and aponeurotic attachments. In region of posterior nasal spine muscle fibers were about 1 mm. from bone; midway between posterior nasal spine and maxiliary tuberosities they were some 12 mm. from bone and in area of palatine foramina they were some 4 mm. from posterior border of hard palate. Finally, retention and stability of prosthetic denture are dependent upon elasticity of tissues of soft palate as palatine aponeurosis upon which denture is supported appears unsuited as border tissue. Palatine glands and adipose tissue supply this cushion.

2. CLASSIFICATION OF CYSTS OF THE TOOTH BEARING BONES. *Hamilton B. G. Robinson, D.D.S., M.S., Washington University, St. Louis, Mo.* On basis of development, structure and radiographic appearance a classification of cysts of maxilla and mandible has been developed. Classification follows:

I. Development cysts
   A. From the odontogenetic tissues
      1. Periodontal (a. Radicular or dental root apex, b. Lateral, c. Residual)
      2. Dentigerous
      3. "Follicular" or primordial
   B. From non-dental tissues
      1. Median (a. Maxillary, b. Mandibular, c. Palatine)
      2. Naso-palatine (incisive) canal
      3. Globulo-maxillary

II. Cystic neoplasms
      1. Ameloblastoma

For completeness of radiographic and clinical diagnosis the following which are not true cysts but which may appear cystic, should be considered:

A. Extravasation "cyst" (hemorrhagic or traumatic)
B. Bone destruction produced by neoplasms
C. Bone destruction produced by metabolic disease
D. Bone destruction produced by inflammation

3. PRELIMINARY REPORT ON USE OF "CALGON" AS AN AID IN PERIODONTAL TREATMENT. *D. A. Kerr, M.S., D.D.S., and Henry Field, Jr., B.S., M.D., University of Michigan, Ann Arbor, Mich.* The chemical composition and the chemical reactions of "Calgon" were discussed. Tests made on extracted teeth and on silicate material were described and evaluated. Methods used in treating patients were described and the results evaluated.

4. BLOOD STUDIES IN PERIODONTOCLASIA. *Benjamin Tenenbaum, B.S., D.D.S., and Maxwell Karshan, Ph.D., Dental and Medical Schools, Columbia University, New York City, N. Y.* Blood was analyzed in 69 patients, 14 to 61 years of age, with advanced periodontoclasia, and in 22 individuals (control group), 17 to 60 years of age, who were free from this condition. Determinations were made for total calcium, inorganic phosphate, phosphatase, protein, sugar, uric acid, carbon dioxide combining power, cholesterol and vitamin C. In periodontoclasia patients, analyses were made immediately before all their remaining teeth (at least 12) were extracted. Fifteen patients in this group gave normal blood values. In the 54 cases which gave 1 or more values outside normal ranges, 8 calcium, 2 inorganic phosphate, 13 phosphatase, 2 uric acid, 19 sugar, and 10 cholesterol values were above the upper limit of generally accepted normal ranges (for cholesterol this was taken as 260 mg. per 100 cc. of plasma, highest value in control group). Two calcium, 2 inorganic phosphate, 6 phosphatase, 23 vitamin C, and 3 cholesterol values were below low limit of normal (for cholesterol this was taken as 100 mg. per 100 cc. of plasma, lowest value in control group). Values for protein and CO_2 combining power were in normal ranges. In control group, 3 vitamin C values were below normal while all other constituents were in normal ranges. In periodontoclasia group, out of 51 cases tested for red cell sedimentation rate, 27 gave values above normal, whereas only 2 control cases out of 24 showed a high rate. (A preliminary report was published in *J. D. Res.* 20: 310, 1942.)

5. INDUCED VINCENT'S INFECTION IN DOGS. *Henry M. Swenson, B.S., D.D.S., Indiana University, School of Dentistry, Indianapolis, Ind.* Normal healthy dogs with good oral hygiene were selected for this experiment. Photographs and smears for Vincent's organisms were taken during the course of the problem. The dogs were injected intravenously daily with 1/20 mgm. Scillaren B and regurgitated most of the food ingested. After 3 injections, an increase in fusiform bacilli and spirilla were observed. In 8–10 days, ulcerative lesions from which Vincent's organisms were isolated occurred on the buccal mucosa, gingiva, and tongue.

6. CAUSES OF PHYSIOLOGIC TOOTH MOVEMENT. *Harry Sicher, M.D., and Joseph P. Weimann, M.D., Foundation for Dental Research of the Chicago College of Dental Surgery, Loyola University, Chicago, Ill.* It is well known that the physiologic movements of fully developed teeth are always accompanied by changes in the alveolar bone. It is highly controversial whether bone apposition and resorption are the cause or the consequence of tooth movement. An analysis of the growth of the molars and the surrounding alveolar bone in the rat led to the conclusion that the disto-occlusal movement of these teeth is the result of a differential growth pattern of bone and cementum. Bone grows by apposition in restricted, well-defined areas. Such areas are the mesial surfaces of the alveolus, the fundus, and the crests of the alveolar septa of the rat molars. In contrast cementum shows continual apposition on its, entire surface, and is, therefore, covered by a layer of uncalcified matrix, cementoid tissue. As are other uncalcified hard tissues, cementoid is relatively im-

mune to resorption. Apposition of bone, e.g., on the mesial wall of the alveolus, leads to a slight increase in pressure in the mesial periodontium. This does not cause resorption of the opposing root surface, but effects a distal movement of the tooth; narrowing of the distal periodontium is then manifested in a resorption of the distal alveolar bone leading to a reestablishment of the equilibrium between tooth and bone.

7. REDUCING SUBSTANCES IN EXPECTORATED STIMULATED SALIVA. *G. Van Huysen, D.D.S., George B. Diefenbach, B.S., D.D.S., University of Louisville, School of Dentistry, Louisville, Ky.* One hundred ninety-one (191) samples of stimulated expectorated saliva taken from 8 individuals were examined for reducing substance content by means of the Hagedorn-Jensen method. It was found that the mean value $\left(\frac{\Sigma N}{N}\right)$ of these determinations was 0.007 mg. of R.S. per 0.1 cc. of saliva. The standard deviation was calculated as ± 0.002 mg.

8. CHEMICAL CHANGES IN DEVELOPING ENAMEL. *Martin Deakins, D.D.S., Ph.D., School of Dental Medicine, Harvard University, Boston, Mass.* In calcifying pig enamel calcium, phosphorus and CO_2 are deposited in the ratio 50:25:4 which is constant between specific gravities of 1.45 and 2.80, that is, between the lowest and highest degrees of calcification found in unerupted teeth.

9. "CASCELLIUS REMOVES OR RESTORES BAD TEETH." *G. B. Denton, Ph.D., Northwestern University Dental School, Chicago, Ill.* The line concerning Cascellius from Martial's Epigram LVI, Book X, has been quoted often by dental historians without indicating its special significance. Its particular importance lies in the fact that it is the earliest clear indication of the unitary existence of dentistry, since it is the first mention of the performance of dental surgery and dental prosthesis by one person.

VI. SECOND SESSION: AFTERNOON; MARCH 18; ABSTRACTS 10–21

10. ALTERATION OF TOOTH FORM IN THE RAT BY THE PREERUPTIVE DIET. *Gerald J. Cox, Ph.D. and Margaret Matuschak Levin, B.S. in Chem., The Nutrition Fellowship of The Buhl Foundation, at Mellon Institute, Pittsburgh, Pa.* Rats were fed, from the beginning of pregnancy, 2 general types of diets: *Type A.* Casein, 20; sucrose, 66; Crisco, 10; Osborn and Mendel salt mixture, 4, or its equivalent without calcium and phosphorus or with double the normal content of these elements. *Type B*, Lean beef, 90; beef liver, 10; additions of calcium carbonate and haliver oil or both. The young were weaned at 21 days and placed on the Hoppert, Webber and Canniff simplified caries-producing diet for 8 weeks. It was discovered that the fused cusp areas of Cox, Dodds, Dixon and Matuschak (*J. D. Res.*, 18: 469, 1939) varied in the extent of fusion. In rats from the Type A rations in Areas 3 and 4, for example, the cusps were fused in 65% of the cases in 91 rats observed. In rats from the Type B rations, fusion occurred in 10% of the Areas 3 and 4 in 197 rats. Cusp fusion was unrelated to the calcium, phosphorus and haliver oil contents of the rations. The factor of differential attrition by the post-weaning ration is not excluded in this study whose object was the observation of caries. Examination of the

teeth of rats at 21 days of age, following varied rations fed to the mothers, provides a means of study of the elimination of a fissure between cusps of the rat molar that may be related to the fissures of the human tooth.

11. Histogenesis of the cylindroma of the palate. *Wm. H. Bauer, M.D., D.D.S., Dental School, St. Louis University, St. Louis.* Comparative histologic studies of cylindromas, mixed tumors and adenocarcinomas of palate were conducted to bring clarity into confused situation in regard to genesis and classification of cylindroma. Cylindromas of salivary and mucous glands are regarded by some authors as a type of mixed tumor. While the epithelial origin of their parenchym is now universally agreed, the question about development of hyalin stroma, its relationship to epithelial cells and connective tissue is not settled. Cylindroma of palate exhibits pure features of this neoplasm. It is usually sharply separated from smooth palatal mucosa and surrounding tissue by broad layer of more or less hyalinized connective tissue which branches into the epithelial parenchym, dividing it into many lobes which are again pierced by same hyalinized stromal tissue. These hyalinized strands and globules contain elastic fibers and form network within epithelial structures which show mostly glandular and tubular arrangement. Cells of parenchym are derived from acinar epithelium of mucous glands or basket cells of their ducts. The secreting cells produce homogenous mucous substance which collects in acini and also covers like membrane surface of epithelial cords and takes up hematoxylin stain. Stromal connective tissue comes into contact with this epithelial product by growing along surface of epithelial strands but also penetrating into cavities which contain this substance. It is this close union between connective tissue and epithelial product that brings about the transformation of the stromal tissue into hyalin. Cylindroma is a neoplasm of a definite kind. It is type of adenoma that arises from mucous glands and their ducts. It is an adeno-myoepithelioma. It is neither to be classed as variety of mixed tumors nor as adenocarcinoma. Cylindroma of the palate in its pure form exhibits pathologically benign characteristics yet may take on tendency of recurrence and even undergo malignant transformation with metastases.

12. Alveolar bone of the molar in the rachitic rat and the effects of parathyroid hormone. *Joseph P. Weinmann, M.D., Foundation for Dental Research of the Chicago College of Dental Surgery, Loyola University and Isaac Schour, D.D.S., Ph.D., University of Illinois, Chicago, Ill.* The alveolar bone of the molar was studied in histologic sections in 4 groups: *A*, 17 rachitic rats (Steenboeck-Black diet, No. 2965); *B*, 23 rats on a normal basal diet injected with parathyroid hormone; *C*, 38 rats on a rachitogenic diet injected with parathyroid hormone; *D*, 16 littermate controls on a basal diet. The findings were: *Group A.* (Rachitic rats) Bone forms at a normal rate but remains uncalcified and persists as osteoid tissue. The bone increases in amount because of lack of resorption of the osteoid tissue. *Group B.* (Normal rats with parathyroid hormone) Injections of 100 or more Hanson Units of parathyroid hormone result in progressive osteoclasis of the bone and replacement of the

bone by fibrous tissue. *Group C.* (Rachitic rats with parathyroid hormone) The reaction of the bone to parathyroid hormone is essentially the same in normal and rachitic rats except for the fact that the osteoid tissue in the latter is almost immune to resorption.

13. DEFENSIVE AND REPARATIVE POWER OF THE DENTAL PULP. *Balint Orban, M.D., Foundation for Dental Research of the Chicago College of Dental Surgery, Loyola University, Chicago, Ill.* The pulp contains all cellular elements necessary for defensive and reparative function. As defensive reaction, inflammation is mainly considered. Bacterial invasion of dentinal tubules and penetration of their toxins bring about migration of leukocytes from blood vessels. Leukocytes can also migrate into dentinal tubules. When a larger number of leukocytes accumulate close to dentin, and partly in it, they might bring about a dissolution of the dentin by their proteolytic action. In such case giant cells might appear acting probably as foreign body giant cells or possibly as osteoclasts assisting the leukocytes in eliminating damaged tissues. Such giant cells have been found to develop in close proximity to odontoblasts. It was generally believed that when resorption of the pulpal surface of the dentin takes place odontoblast must have previously disappeared and their place taken by fibrous connective tissue, giving rise to osteoclasts. Repair of such an area was believed to take place by deposition of bone. This is considered to be due to metaplasia of the pulp, or to replacement of the pulp by periodontal connective tissue. Extracted human teeth, with inflammatory pulp reaction, have shown cases where the resorbed dentin surface was repaired by formation of first, irregular, then regular, dentin.

14. POSTNATAL GROWTH PATTERN OF THE CRANIUM AS MEASURED BY VITAL INJECTIONS OF ALIZARINE RED S. *Maury Massler, D.D.S., M.S., School of Dentistry, University of Illinois, Chicago, Ill. Method:* Vital injections of Alizarine Red S stain actively growing bone forming and calcifying at the time of the injection, demarcating sites of active bone deposition grossly and microscopically. Multiple injections permit analysis of various sites of bone growth in terms of (1) method and pattern of bone deposition, (2) relative and absolute rates of bone growth and (3) their chronology. *Materials:* (1) More than 200 albino rats were given single and multiple injections from birth to old age; (2) 58 Rhesus monkeys were similarly injected from birth to old age; (3) 5 human infants 1 month to 2 years of age, available for such study because of inoperable conditions were similarly injected. *Findings:* (1) Two developmental periods can be recognized grossly; (a) an early period of generalized growth in which apposition occurs upon all bony surfaces (ectocranial, endocranial and intersutural) and (b) a later and more prolonged period of localized growth in which bone deposition is confined to certain definite sites (endocranial and intersutural) and for certain chronologic periods (detailed charts are available on request). (2) Increase in thickness of cranial bones occurs by endocranial simple surface depositions. (3) Increase in size or volume of cranium occurs as result of intersutural bone growth. (4) Intersutural growth is very rapid because (a) 2 surfaces are available for bone deposition and (b) growth is by

finger-like projections instead of smooth-surface apposition. These result grossly in sutural denticulations and in gomphosis attachment between bones. (5) Increase in width of cranial vault occurs by growth at sagittal suture. (6) Increase in cranial length occurs anteriorly and posteriorly at (a) anterior (coronal) ring of growth which consists of coronal suture in vault and spheno-frontal and spheno-ethmoidal complex of sutures in anterior cranial base, and (b) posterior (lamboidal) ring of growth which consists of lambdoidal suture (and accessory lambdoidal suture when present) in cranial vault and spheno-occipital junction (by endochondral bone formation) in posterior cranial base. (7) Sutures and suture complexes are always so arranged in 3 planes of spaces as to be at right angles to direction of growth. (8) Increase in cranial length is greater than increase in width as result of (a) greater number of sutural sites of growth in this direction and (b) these sites grow for longer periods of time. (9) Cessation of sutural growth precedes suture closure but occurs in same order: Sagittal suture, coronal ring, lambdoidal ring.

15. HEREDITARY DENTAL MORPHOGENESIS IMPERFECTA. A GENETIC STUDY OF TEETH OF ALBINO RAT. *I. Schour, D.D.S., Ph.D., M. Massler, D.D.S., M.S., and R. O. Greep, Ph.D., College of Dentistry, University of Illinois, Chicago, Ill., and Department of Pharmacology, Squibb Institute for Medical Research, New Brunswick, N. J.* A strain of albino rats having no erupted incisors or first molars was discovered and bred true over many generations (Greep, R. O., *J. Heredity*, 1941). Second and third molars are partially erupted. This condition is inherited as simple Mendelian recessive factory not sex-linked. Complete series of 80 "incisorless" albino rats were sacrified at regular intervals from 14 days in utero to 368 days of postnatal life, 18 normal siblings being used as controls. Roentgenographic analysis revealed large odontomes in incisor area and displacement and distortion of molars. Histologic analysis revealed following: (1) Prenatal tooth development in both incisors and molars normal. (2) At about birth tooth development in incisors and first molars is disturbed in characteristic and constant manner. Proliferating tips of the enamel epithelium of incisors and first molars become markedly distorted. Spicules of alveolar bone are encroaching upon tooth and odontogenic epithelium with consequent localized obliteration of dental follicle. Structure of the enamel and dentin is normal. Chief effect, therefore, is severe disturbance in morphology of teeth. (3) Effect is cumulative so that with increase in age the incisor develops into large unerupted complex odontome which intermingles among spicules of bone and is extensively ankylosed. (4) First molars also show increasing distortion with age. (5) Second and third molars which develop later show less severe disturbances than do first molars. This strain of rats permits controlled study in genetics of tooth development. It offers opportunity to study effects of genetic disturbance upon developmental process and points out importance of temporal element in operation of aberration. A number of findings in the teeth and the bone resemble those observed by Grüneberg in the grey-lethal mouse (*J. Anat.*, 71: 236, 1937).

16. MUSCLE TENSION AND VERTICAL TOOTH POSITION. *T. D. Speidel, D.D.S.*,

M.S., and R. C. Davis, A.B., Ph.D., School of Dentistry, University of Indiana, Indianapolis, Ind. An earlier study (1941) showed very low correlation between muscle tonus and vertical position of posterior teeth as indicated by incisor overbite (correlation coefficient 0.28). Because of possibility that this low correlation was due to technique then used for determination of muscle tension, present preliminary study was carried out. In project now being reported, 15 children, aged 8 to 10 years, were studied. Their overbites were measured directly and ranged from 0 to 5.3 mm. Their muscle tension status was determined by recording electrical excitation in area of masseter muscle. These electrical changes were amplified and oscillograph waves photographed on moving film. Measurement of muscle tension was derived from analysis of photographic recordings. Tension recordings were made with subject at "rest," lying prone and inactive, and also during performance of set activity, that of lifting 50, 100, and 300 gram weights. Correlation of overbite measurement with jaw tension measurements at rest showed a very low degree of correlation (coefficient 0.12). Correlation of overbite measurements with increase in tension in masseter musculature during weight lifts was slightly higher but still inconclusive (0.33). Three subjects with relatively low overbite measurements showed relatively small tension increase during weight lifting and 4 children with relatively large increases in tension had relatively large overbites. However, several children with large overbites did not show large increase in tension. Overbite was correlated with third measurement, ratio of increase in tension occurring in jaw musculature to increase in tension which occurred in musculature of arm performing weight lifting. Correlation of this ratio with overbite showed slightly greater proportionate relationship (correlation coefficient 0.41). It is obvious that number of subjects studied is much too small to permit drawing definite conclusions. However, correlation coefficient of 0.41 obtained in this study is slightly higher than that from previous study. This suggests that ratio of increase in tension in jaw to increase in tension of musculature performing a voluntary action may be an indication of muscle tension which should be studied more extensively.

17. STATISTICAL ANALYSIS OF LOCAL ANESTHETIC CASE HISTORIES. *S. M. Moose, A. H. Throndson, M. L. Tainter, H. M. Schamp, College of Physicians and Surgeons, San Francisco, Cal.* 1400 patients presented for oral surgery and were injected with from 1 to 21 cc. of local anesthetic each. They were all examined by one of us (A. L. T.). It was shown that average systolic blood pressures were 4.6 mm. Hg higher than expected normal for age group, but otherwise patients were normal. Various correlations showed that no group of patients were treated with any especial precautions. Results indicate that: those patients requiring injection of larger volumes of anesthetic showed greater pulse rate and systolic and diastolic pressure changes, more cases of perspiration and tremors, and fewer cases of septic alveoli; patients with higher pulse rates tended to bleed more at the time of injection, to have deeper, longer-lasting anesthesia, to show more perspiration and nervousness, and to show greatest drops in pulse rates; patients with higher systolic blood pressures experienced

poorer anesthesia, which, if it occurred, appeared at normal time, without undue initial pain, and lasted normal time, in addition to which they experienced more bleeding at time of injection, greater increases in systolic pressures, less perspiration and fainting, and, strangely, fewer septic alveoli; and patients with high initial diastolic pressures were the same as those with high systolic pressures.

18. STUDIES ON AVIATION DENTISTRY. PARTS I–VIII. *R. F. Sognnaes, L.D.S., M.S., Ph.D., R.N.A.F., Toronto, Ontario, Canada.* An attempt has been made to collect, review and discuss as an entity all literature pertaining to oral conditions of aviators (I). From a large number of airmen with various types of dental pathosis (II) several groups of student pilots, representing extremes in dental conditions, have been tested with respect to the effect on the teeth and jaws of barometric pressure-changes (III, IV) and accelerations (V, VI), while the combined significance of these and other factors encountered in the air have been observed in experienced pilots through questionnaires and case histories (VII). The report is concluded with a chapter on the more practical aspects of aviation dentistry (VIII) suggesting certain principles in the care of aviators' teeth.

19. SOME OBSERVATIONS ON PLASTIC RESTORATIVE FILLING MATERIALS. *Joseph F. Volker, Stanley Mellilo and E. C. Belkakis, Tufts College Dental School, Boston, Mass.* Detailed examination has been made of over 100 silicate and 150 amalgam restorations that have been removed because of physical deficiencies or a continuation of the carious process. The average silicate filling was removed from a mouth having a D.M.F. of 21 after giving over 5 years service. Approximately 80% of the cases showed no reoccurrence of caries on the margin, floor, or on the approximating surface. It is suggested that the fluoride content of the silicate cements may account for the decreased caries susceptibility. The average amalgam filling was removed from a mouth with a D.M.F. of 19 after giving almost 6 years service. About 75% of the restorations showed reoccurrence or continuation of the carious process either on the margin or floor of the cavity and two-thirds of the approximating teeth showed carious involvement.

20. SALIVARY COUNTS IN HUMANS FOLLOWING VACCINATION WITH ORAL LACTOBACILLI. *Ned B. Williams, A.B., D.D.S., Army Dental School, Washington, D. C.* An equal mixture of 2 widely cross agglutinating organisms, among stock strains of oral lactobacilli, was used for subcutaneous inoculation of 23 human volunteers, once weekly for a period of 4 weeks. Heat-killed as well as living types of vaccine were injected simultaneously in opposite arms. Responses to living vaccine were more intense than to heat-killed, but both were characterized by soft pink areas which disappeared in 4 to 5 days without abscess formation or any induration. Agglutination tests between sera and vaccine strains demonstrated that increases in titers were maximal from 2 weeks to 1 month after vaccination. Later there was a gradual decrease until at 5 months only a few showed titers above their previous "normal" levels. Tests, under similar conditions, of 13 unvaccinated controls demonstrated no changes in their titers. Salivary counts for oral lactobacilli were averaged before and

after for persons in the vaccinated as well as in the unvaccinated groups. Statistical analysis of the averages in the former group revealed that 6 of the 23 had reductions in count greater than could be accounted for in the basis of chance. Among the remaining 17 in this group, 7 showed an increase in count and the others had reductions which were within the limits of chance variation. No significant differences were observed in the control group. Dental examinations, supplemented with bite wing x-ray films, before vaccination as well as 3 and 6 months after, gave no evidence of any changes in the dental health of the groups. On the basis of these findings and within the limits of the study, it is concluded that the salivary counts for lactobacilli are not appreciably affected by the increased blood agglutinin titers following subcutaneous injection of oral lactobacillus vaccines.

21. VISUALIZATION OF REACTIONS ON DENTIN AND ENAMEL. *Wilmer Souder, Ph.D. and Irl C. Schoonover, Ph.D., National Bureau of Standards, Washington, D. C.* The method of observing abrasion, erosion, and chemical attack of dentin and enamel surfaces with the aid of calibrated indentation marks has been expanded and improved. The method has been employed to investigate the action of fluoride solution recommended for controlling caries and sensitive areas on enamel and dentin. Preliminary experiments in this field indicated that the desensitization and protection against caries may result from absorption of fluorides followed by their conversion into insoluble calcium fluorides. Surfaces of dentin severely eroded and pitted by a dentifrice are in some degree restored by the application of fluorides followed by calcium salts. In the normal mouth calcium present in the saliva would be sufficient for such reactions. The illustrations included micrographs from optical and electron microscopes.

VII. THIRD SESSION (DENTAL MATERIALS SECTION): SATURDAY EVENING; MARCH 18; ABSTRACTS 22–27

22. STUDY IN CASTING DENSITY. *Donald A. Keys, A.B., D.D.S., University of Nebraska, Dental School, Lincoln, Nebr.* 1. Evidence to reveal deficiencies present in the inlay when improper methods of sprue attachments are used can be demonstrated by examination of specimens under low power magnification. From tests made it was concluded that a sprue attachment ranging in diameter from 12 gauge (standard wire) to 16 gauge was best suited for usual various weight inlay castings. 2. In another set of tests casting density does not appear to be affected by crucible former shape. As a means of contrast castings were made by using an extremely flat former and one of a particularly long cone shaped design with no apparent differences in casting density. 3. It is believed that the practice of vibrating in investing process is detrimental. This disturbs investment consistency and tends to increase possibility of trapping air under wax pattern surface. 4. Investment mixed by combining powder with water by a sifting action, incorporating powder and water by a cutting motion of spatula, and finally using a slow mechanical spatulation of 45 to 50 turns gives a consistent and homogenous investment mix. Air pockets commonly encountered by a fast whipping hand or mechanical mixing are eliminated.

Castings with a very smooth surface are usually the result with this method of water-powder incorporation. 5. Tests to compare the superiority of a low or a high heat technique demonstrated that surface condition only was affected in higher heat method, but internal structure appeared not to be influenced.

23. Acrylic resins for tooth restorations. *E. W. Skinner, Ph.D. and E. N. Cooper, B.S., Dental School, Northwestern University, Chicago, Ill.* Cylindrical specimens (approximately 4.5 x 4.7 mm.) of a commercial inlay acrylic resin were compared with similar specimens of an experimental direct-filling acrylic resin for changes in hardness, specific gravity, weight and volume when immersed in water over a period of 15 weeks. All specimens were conditioned over $CaCl_2$ before beginning tests. Brinell hardness numbers, obtained by the silhouette method under a load of 6.4 kg. applied for 30 seconds, were 19 ± 1 and 13 ± 2 for the inlay and the direct-filling resin respectively. No hardness difference was found between wet and dry conditions. After the initial conditioning, the sp. gr. of the inlay resin was 1.145 and that of the direct-filling resin was 1.125, whereas the values were 1.175 and 1.132 respectively after water immersion at 37°C. for 15 weeks. The maximum weight-percentage water sorption during this period was, in the same order, 1.7% and 8.6%. The percentage volume change of the inlay resin, after an initial expansion of 5.2% during the first 2 weeks, was -0.9% at the end of 15 weeks. This apparent shrinkage was thought to be caused by strain release.

24. Clinical research on direct acrylic resins. *Fred A. Slack, Jr., D.D.S., H. D. Justi and Sons, Philadelphia, Pa.* Direct mouth polymerization of methylmethacrylate involves heretofore unconsidered phases. Accelerated polymer is saturated with monomer and test pellets approximately the bulk of a large filling are produced, treated to mouth conditions, and measurements observed. They were observed to shrink abruptly during the first 30 days and hereafter more slowly. Percentage shrinkage varied from 0.10 to 1.14. Fillings utilizing the same material and the same technique were placed in deep seated cavities in human teeth. Observations are being continued thereon. One month after insertion the fillings appeared sound. Further work is indicated.

25. Physical properties of amalgam as influenced by mechanical amalgamator and pneumatic condenser. *Ralph W. Phillips, B.S., University of Indiana, School of Dentistry, Indianapolis, Ind.* Twenty commercial amalgam alloys, purchased on the open market, were tested for expansion, flow, 24 hour crushing strength, and 1 hour crushing strength. They were mixed and packed according to the following methods: 1. Mortar and pestle packed by hand. 2. Mechanical amalgamator (without steel pellet) packed by hand. 3. Mechanical amalgamator (with steel pellet) packed by hand. 4. Mechanical amalgamator packed by pneumatic condenser. Data and graphs show the advantages and disadvantages as pertaining to these various physical properties by the use of these mechanical devices. Advantages and disadvantages of the use of the steel pellet with the mechanical amalgamator are shown.

26. Stability of some acrylic resin denture base materials. *Naomi*

S. Steck, B.S. and Ida M. Harman, A.B., Vernon-Benshoff Co., Pittsburgh, Pa. Report on 24 specimens, 12 brands, of acrylic resin, studied for dimensional change and water sorption (37°C) for 18 months. Specimens were 6 x 6 x 0.10±.03 cm., cured at 212°F for 15 minutes under positive pressure against stainless steel ruled plate (50 x 50 mm.). Linear dimension measured with microscope and weights taken on analytical balance. Average water sorption was 1.44%. Weight increase in water reached maximum in about 10 days. Dimension is stable in wet condition to 0.05%. Differences between plasticized and unplasticized material shown. After 18 months in water average size of acyrlic resin was 0.16% and vinyl acrylic 0.22% less than steel plate. The uniformity of physical properties of an unplasticized acrylic denture material is demonstrated by summarizing production control tests, according to A.D.A. Specification 12, on 50 tons of polymer. Water sorption varies from 0.52 to 0.60 mg/cm², with an average of 0.57. Solubility ranges from 0.004 to 0.050 mg/cm², and averages 0.02 mg/cm². In the transverse test, deflection at the critical loads of 4000 and 6000 grams can be predicted to within 4% and 6% at these two points respectively. The average transverse strength is found to be 7020 grams for powder-liquid and 7140 grams for gel. A practical method is suggested for mechanical production of the transverse specimens.

27. THE EFFECT OF PARTICLE SIZE ON THE FLOW OF DENTAL AMALGAM. *J. R. Jarabak, D.D.S., M.S., and E. W. Skinner, Ph.D., Northwestern University Dental School, Chicago, Ill.* A study of the effect of particle size on the flow of dental amalgam has been made. Four particle sizes were studied; those retained in the 100, 200, 325, and those passing the 325 mesh sieves. It was observed that in 3 of the 4 alloys studied, constant and total flow values were almost identical for all particle sizes. Mechanical and manual trituration did not give enough deviation to warrant the recommendations of one procedure over the other. Eight pound manual condensation gave results identical to mechanical condensation. The factor affecting constant and total flow in the greatest degree was inadequate condensation. It may be presumed from this study that condensation will affect the flow of dental amalgam to a greater degree than trituration and particle size.

VIII. FOURTH SESSION: SUNDAY MORNING; MARCH 19; ABSTRACTS 28–38

28. PRELIMINARY STUDY OF THE HUMAN PULP AS A TISSUE CULTURE PROVING GROUND FOR NEW CHEMOTHERAPEUTIC DRUGS. *Herbert M. Phililips, B.S., D.D.S., Northwestern University Dental School, Chicago, Ill.* The human pulp was used as a proving ground for study of the action of the sulfonamides. The pulps were exposed in 19 non-carious teeth condemned to extraction but not involved in periodontal disease. Ten were implanted with sulfathiazole, 9 were left as controls. Nineteen specimens, presumed infected because of carious exposure, were mechanically opened and 14 were implanted with sulfathiazole and 5 were left for controls. All exposures were made aseptically and sealed with cement. The experimental intervals ranged from 2 hours to 273 days,

and the 16 patients varied from 12 to 57 years in age. This preliminary study showed that pulps are suitable for a critical study of chemotherapeutic drugs for several reasons. Connective tissue is removed every time a "vital" tooth is extracted and this tissue is enclosed by the dentinal walls where the cytological relationships survive the extraction and may remain intact through the preparation of histological sections. Pairs of analogous condemned teeth often occur in the same mouth and offer excellent possibilities for controlled experimentation. Infected pulps are found in teeth exposed by decay and these studied with adequate bacterial techniques might shed light on the basic bacteriostatic properties of the chemotherapeutic drugs. Pulps also occur in an uninfected condition in non-carious teeth without periodontal disease and are appropriate for studying the secondary properties and tissue reactions of these drugs in the absence of infection. The pulp tissue may be considered representative because it shows all the defensive and inflammatory reactions common to connective tissue, it is particularly sensitive and may record minute toxic responses. Subjective, bacteriologic and radiographic observations made while the tooth is in situ may be correlated with bacteriologic examination and post mortem histological data. The sulfathiazole implanted teeth showed no more inflammatory reaction that could be attributable to the drug. Points that were suggested in the study are that sulfathiazole may have a salubrious action in pulp wounds, an analgesic or obtunding effect, a suppressing action on pulp flora, and probably does not induce interstitial hemorrhage, as claimed by some. Due to a slow but progessive degeneration in both control and implanted pulps the short intervals are most reliable and the large, young pulps are best for observation. As the pulp does not regenerate readily and lacks an epithelial covering, the effect of the drug on the healing phase may not be adequately studied in the pulp.

29. STATISTICAL ANALYSIS OF THE CONSTANCY OF CERTAIN FACIAL DIMENSIONS. *Wendell L. Wylie, A.B., D.D.S., M.S., University of California, San Francisco, Cal.* Brodie (1941) and Herzberg and Holic (1943) have shown on randomly selected samples of the general population that the nasal area and the dental area contribute 43% and 57% respectively to total face height when the teeth are occluded. Wylie (1944) verified, with a similar sample, these findings and gave coefficients of variation establishing that there is little variation about these mean values. In this study it is shown that where malocclusion exists, the mean value for the dental area is only 54.16% of total face height when the teeth are in occlusion. The difference between this mean and previously reported means for the general population can be shown statistically to be highly significant. In the same sample of malocclusion cases, the mean for dental area is 56.33% of total face height in the physiologic rest position; this mean does not differ significantly from that of the general population. The difference between the mean of 54.16% for occlusion and 56.33% for physiologic rest position is highly significant. Coefficients of variation indicate that there is more constancy about the mean in physiologic rest position (C.V.=4.42%) than there is about the mean in the occluded position (C.V.=5.30%), although

the size of the sample does not permit the demonstration of a significant difference. Cofficients of variation are given for other facial dimensions expressed in terms of percentage of total face height, demonstrating that nasal height and dental height are among the most constant of craniofacial dimensions.

30. CEPHALOMETRIC ROENTGENOGRAPHIC DIAGNOSIS OF NORMAL AND ABNORMAL POSITION OF THE MANDIBLE. *John R. Thompson, D.D.S., M.S.D., M.S., University of Illinois, College of Dentistry, Chicago, Ill.* The physiologic rest position of the mandible is established and maintained by a balance of the associated musculature. This relationship of mandible with maxilla and cranium is established before any of the teeth have erupted and it is maintained after the teeth have been lost. When the mandible is at physiologic rest a free way space exists between the mandibular and maxillary teeth. Since this position is stable it is the logical basis for diagnosing abnormal relationship of mandible with maxilla when the teeth are occluded. This can be done by detecting any deviations from the normal path of movement of the mandible from physiologic rest position to its occluded position. Normally the mandibular incisors and chin point move upward and forward until occlusion is attained. The fulcrum for this movement is in the lower half of the temporomandibular joint. There is no bodily displacement of the mandible. In certain malocclusions characterized by a deep overbite the mandibular incisor and chin point move upward and backward. The mandible is bodily displaced upward and backward because of the deep overbite. This is most frequently observed in Class II Division 2 (Angle) malocclusions. Forward and lateral bodily displacement of the mandible can also be detected. Lateral cephalometric x-rays with the mandible at physiologic rest and with the teeth occluded are made. Tracings of these x-rays are superimposed on the cranium and upper face. The path of movement of the mandible from physiologic rest to occlusion can then be examined.

31. ANGLE OF INCLINATION OF HUMAN INCISORS. *H. J. Noyes, D.D.S., M.D., C. H. Rushing, D.D.S., M.S.D., and H. A. Simms, D.D.S., M.S.D., Northwestern University, Dental School, Chicago, Ill.* Cephalometric analysis was used to study cases of malocclusion with reference to axial inclination of human first incisors and the relationship between position of these teeth and occlusion classes.

32. THE INCISOR-MANDIBULAR PLANE ANGLE, ITS RELATION TO THE CHIN IN MAN AND OTHER PRIMATES AND ITS CLINICAL SIGNIFICANCE IN ORTHODONTICS. *Herbert I. Margolis, D.M.D., Boston, Mass.* The incisor-mandibular plane angle is that angle formed by a line drawn through the mandibular first incisor and the mandibular plane on a standardized sagittal cephalic x-ray. A comparative study of that angle in anthropoids, primitive and modern man shows a progressive "uprighting" of the mandibular incisors with relation to the mandibular plane. If the orthodontist increases the incisor mandibular plane beyond a right angle he is increasing the process suggested by studies of development of modern man. In the majority of white individuals, the most beautiful faces present an incisor-mandibular plane angle of $90° \pm 3°$. In diag-

nosis consideration must always be given to other structures of the face, particularly the length of the ascending rami and the gonial angle; also when incisors though perpendicular to the mandibular line are bodily displaced forward. The orthodontist can alter the lower third of the face very materially by affecting the axial inclination of the mandibular incisors, a fact suggested to the author as a result of his study with Charles H. Tweed, Jr. It is the authors belief that consideration of the incisor-mandibular plane scale is a basic principle in orthodontics.

33. ACTIVE AND PASSIVE TENSIONS OF THE BUCCAL MUSCULATURE AS CHARACTERIZED BY INTRAORAL PRESSURES. *David B. Scott, D.S.D., University of Rochester, School of Medicine and Dentistry, Rochester, N. Y.* Pressures exerted in the direction of the teeth by the buccal musculature in relaxation, during maximum contractile effort, and at various stages of cheek stretch were measured by means of an inelastic balloon placed between cheek and teeth and connected to a recording manometer. Theoretical muscle tensions were calculated from the radius of curvature of the cheek. Maximal tensions fell in the range of those of other striated muscle. The passive musculature at resting length exerted an infinitely low pressure against the teeth. Maximal active pressure at the same length averaged 2.0 pounds per square inch. At greatest distension of the cheek, passive pressure reached a maximum of 0.8 pounds per square inch, and active, 5.0 pounds per square inch. Distribution of pressure is under consideration.

34. EFFECTIVENESS OF VARIOUS FLUORIDE PREPARATIONS IN REDUCING TOOTH SOLUBILITY. *B. G. Bibby, Ph.D., D.M.D., Tufts College Dental School, Boston, Mass.* To indicate probable effectiveness of fluoride-containing mixtures in reducing dental caries when used on teeth in form of applications, cleaning agents or dentifrices, solubility-reducing effects brought about by preparations containing fluorides were tested on enamel and dentin. Fifty-milligram lots of pure dried enamel or dentin were stirred with test agent for 20 minutes in Berliner crucibles. After several washings with water they were stirred with sodium acetate-acetic acid buffer, ph 4, for 20 minutes, washed, dried at 110° for 60 minutes, cooled in dessicator and weighed. Weight of tooth substance lost was compared with control results obtained for each of 7 enamel samples by using distilled water instead of a fluoride-containing solution. All tests were run in duplicate or triplicate and results which did not check within 1 mgm. were discarded. Extracts from 13 commercial dentifrices to which sodium fluoride was added to give a final dilution of 1 in 1000 reduced enamel solubility from 8% to 40% below the control values. 0.01 sodium fluoride in water reduced solubility by about 30%. Potassium fluoride gave comparable results and ammonium fluoride some indication of increased effectiveness. Seven tests using 2 samples of hydrogen peroxide and 3 different enamels gave solubility reductions of from 48% to 56%. To determine extent to which this effect was result of the acidity of peroxide solutions series of buffers ranging from pH 3 to pH 11 were mixed with fluorides and tested. It was found that solubility-reducing effect of the fluoride was reduced in the high pH range, but that it was

increased greatly when the acidity was pH 4 or below. Percentages of control solubility fell from 73% and above at pH 6 to 7 to 53% at pH 4. Additions of alcohol, glycerine and zephiran did not significantly change solubility-reducing effects of pH 4 fluoride solutions. Lowering fluoride concentration (to 1 in 10,000) reduced effect on enamel solubility to much greater extent than it did in less acid solutions. More extensive series of tests was carried out on dentin using fluorine-containing buffers of different acidities. This gave even more clearcut results than with enamel and showed greater reductions in solubility. Results obtained with additions of alcohol, glycerine and wetting agents such as zephiran, aerosol, and alkyl sulphate paralleled those obtained with enamel with some indication of increased effect with dilutions of 1/100,000 of zephiran. Potassium fluoride was as effective as sodium fluoride, ammonium fluoride gave comparable results but calcium fluoride solutions were relatively ineffective.

35. ORGANIC MATERIAL IN THE ENAMEL MATRIX OF THE MACACA MULATTA. *M. Land, D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester.* The organic phase of enamel is best studied while that tissue is in the matrix stage. After complete reduction of the ameloblasts, matrix formation halts and the structural elements of the matrix at this time may be viewed intact. Histological examination of second and third maxillary molar tooth germs dissected from the jaws of 2 monkeys (Macaca Mulatta), 30 to 36 months of age, revealed the presence of numerous organic processes penetrating the enamel matrix to various depths. A number of these structures, similar to the lamellae of human enamel, were found in the thin part of the matrix near the future cemento-enamel junction. Several completely penetrated the matrix and were found wedged into the dentin. On the distal surface, in the middle third of a third molar germ, an organic sheath apparently containing epithelial elements penetrated two-thirds the thickness of the enamel matrix. This sheath assumed the shape of a wedge approximately 15 microns in thickness directed toward the dentin and involving an area on the enamel surface almost a millimeter in its cervico-occlusal dimension. The outer borders of the structure stained similarly to keratin. The entire structure appeared to be a part of the matrix in which amelogenesis had been disturbed.

36. ROLE OF DENTINAL PAPILLA IN TOOTH FORMATION. *Harry H. Shapiro, D.M.D., College of Physicians and Surgeons, Columbia University, New York, N. Y.* The intact dental papilla was removed from the developing permanent canine teeth in the mandibles of 2 cats. The reported post-operative radiographic study indicated eruption of experimented teeth. In contrast to controls, the eruption was greatly retarded. Histologic examination verifies radiographic evidence of eruption following papillectomy.

37. TISSUE REACTIONS FOLLOWING PAPILLECTOMY. *William Lefkowitz, D.D.S., and Charles F. Bodecker, D.D.S., School of Dental and Oral Surgery, Columbia University, New York, N. Y.* The removal of papillae from tooth germs resulted in the areas filling with adult connective tissue and bone. The calcium-free inner suface of the dentin was covered with a bone-like tissue of

continuous formation which greatly resembles cementum. In some areas it resembles spike formations. The connective tissue attaching the cementum-like lining of the dentin to the bone is markedly similar in appearance to periodontal membrane. Several clusters of epithelial cells were present in the papillary area. They were encapsulated by collagenous fibers. Later stages showed that the epithelial cells degenerated after encapsulation by bone. The experiments are being continued.

38. THE INFLUENCE OF PAPILLECTOMY ON FORMING ENAMEL. *Charles F. Bodecker, D.D.S. and William Lefkowitz, D.D.S., School of Dental and Oral Surgery, Columbia University, New York, N. Y.* The removal of papillae from tooth germs, in which some dentin and enamel had formed, showed a secession of growth of both structures. Dentinogenesis was expected to stop as a result of absence of odontoblasts, but amelogenesis should have continued if the enamel organ is solely responsible for enamel formation. Report supports tentative conclusions that: (1) the proper function of ameloblasts is dependent on odontoblasts after enamel formation has begun; (2) the mineral salts necessary for the secondary calcification of the enamel originate from the dental papilla and pulp. Work is still in progress.

IX. FIFTH SESSION: AFTERNOON; MARCH 19; ABSTRACTS 39–49

39. THE PATHOLOGICAL AND CLINICAL VIEWPOINT OF THE NEW CARIES CONCEPT. *B. Gottlieb, Baylor University, College of Dentistry, Dallas, Texas.* The formation of a necrotic cavity is the final stage of dental caries. The yellowish brownish pigmentation of the intact tooth tissue is the first stage and remains to the final stage. The extent of that pigmentation at the surface of the tooth has no relationship to its extent into the depth, the only dimension that counts. As long as caries is limited to the enamel it can be arrested. A brownish pigmented strip running parallel to the gingival margin, seldom penetrates through to the dentin thick enamel. Usually it develops at a place of previously chalky enamel, produced by acid which causes the development of a barrier of transparent enamel. There is no indication for cavity preparation. In the extended, brownish pigmented areas of frontal caries, acid action forms most of the spearhead. When acid action has reached the dentin, the tissue shrinks. If the enamel is intact, the created vacuum aspirates the circulating dental tissue fluid. If the enamel is broken, saliva may fill the space created by shrinkage. A shadow inside the dentino-enamel junction appears in the radiograph. Radiographically, enamel may appear partly decalcified but is intact to an explorer. In such a case cavity preparation should not be postponed. The lining of the space between enamel and dentin is smooth in the beginning. Necrosis follows later. As long as the dentin appears intact, no cavity preparation is indicated, no matter how the enamel looks. The enamel can be taken care by impregnation after polishing. In the case of pure frontal caries the invasion roads along the prism sheaths and yellow pigmentation seldom affects dentin considerably, without shrinkage. However, when a free lamella is available, the yellow pigmentation forms the spearhead. On the enamel surface a round, depressed pig-

mented point may be found when an isolated lamella is invaded. A considerable area of the dentin, around the entrance of the lamella may already show yellow pigmentation while signs of acid action do not yet reach the dentino-enamel junction. The dentinal part of the enamel may still be intact. Microgrganisms apparently use the lamella as a pathway. X-ray examination long remains negative, yellow pigmentation not showing up. Cavity preparation should be started right away along the lamella, if the invasion of the lamella is diagnosed. As a rule the dentin will be found affected.

40. INHERITANCE OF SUSCEPTIBILITY AND RESISTANCE TO CARIES IN RATS. *H. R. Hunt, Ph.D., C. A. Hoppert, Ph.D., and W. G. Erwin, Ph.D., Michigan State College, Mich., and Henderson State Teachers College, Ark.* The main objectives of this research are to determine, (1) whether inheritance is a factor in susceptibility and resistance to caries in rats, and (2) the numbers and modes of action of the genes involved. The existence of the inheritance factor has been demonstrated. The problems now remaining are to evaluate the inheritance quantitatively, and if possible to determine the number of gene pairs involved. A caries-producing diet devised by Hoppert and his associates consists of 66% by weight of coarsely ground rice, 30% powdered whole milk, 3% alfalfa leaf meal, and 1% sodium chloride. The rats are transferred to this diet at 35 days of age and are observed for carious lesions every 2 weeks. Caries-susceptible and caries-resistant populations have been built. The breeding method employed for the susceptible line has consisted in mating full brothers and sisters, which developed caries very early, and which came from a sibship which was markedly susceptible. The same procedure has been followed in building the resistant line, except that resistant breeders have been selected from resistant sibships. More than 3000 rats have been recorded to date. The susceptible line has become highly homogenous. The resistant line still shows much variation. The following table presents the means of sibship averages, using sibships of 5 or more rats each. The table is subject to minor corrections.

GENERATION	SUSCEPTIBLE LINE	RESISTANT LINE	DIFFERENCE
2	57 days (8 sibships)	116 days (8 sibships)	59 days
3	43 " (11 ")	142 " (18 ")	99 "
4	37 " (13 ")	168 " (16 ")	131 "
5	32 " (14 ")	187 " (12 ")	155 "
6	29 " (11 ")	248 " (14 ")	219 "
7	38 " (11 ")	240+ " (21 ")	202+ "
8	29 " (8 ")		
9	30 " (8 ")		
10	30 " (9 ")		
11	28 " (7 ")		

(To be published in *J. D. Res.*)

41. THE INCIDENCE OF ORAL L. ACIDOPHILUS IN HUNT-HOPPERT CARIES RESISTANT AND CARIES SUSCEPTIBLE RATS. *Philip Jay, D.D.S., D.Sc., H. R. Hunt, Ph.D., and C. A. Hoppert, Ph.D., University of Michigan and Michigan State College, Mich.* A series of rats of the Hunt-Hoppert caries resistant and caries

susceptible strains were examined for oral lactobacilli. One of 11 adult susceptible rats had a zero lactobacillus count. The remaining 10 yielded counts ranging from 4000 to 10,000. Four of 11 rats of the resistant strain had zero counts. The remaining 7 ranged from 150 to 1000. In order to eliminate any possible effect of existing dental cavities on the oral flora the observations were repeated on young rats before they were placed on the caries producing diet. Six out of 25 rats of the susceptible strain yielded negative counts. The remaining 19 ranged from 50 to 35,000. When examined for caries 100 days after they were placed on the coarse particle diet the 6 zeros showed least evidence of caries. Twenty-four rats of the resistant strain were also examined. Eighteen of these yielded zero counts. The counts of the remaining 6 ranged from 50 to 2000. None had developed caries after 100 days on the coarse particle diet. It was concluded from this study that there was a quantitative difference in the incidence of lactobacilli in the mouths of caries susceptible and caries resistant rats. As in humans there seemed to be a relationship between these organisms and dental caries activity.

42. DENTAL CARIES EXPERIENCE IN HUSBANDS, WIVES AND THEIR OFFSPRING. *Henry Klein, Division of Public Health Methods, United States Public Helath Service, Bethesda, Md.* Approximately 1700 married couples and about 3000 of their children (all of Japanese ancestry) received detailed dental examinations in the fall of 1943. Preliminary analyses of the collected data indicate that a significant relationship exists between the amount of caries experienced by the wife and that experienced by her husband. Women who have experienced, over their lifetime a large amount of caries, have husbands who consistently show a larger caries experience than that shown by husbands of women having small amounts of caries experience. Parents who have experienced the largest amounts of caries have offspring who have approximately 3 times more caries experience than do the offspring (of the same ages) of parents with the smallest caries experience.

43. THE EFFECT ON CARIES INCIDENCE OF A SINGLE TOPICAL APPLICATION OF A FLUORIDE SOLUTION TO THE TEETH OF YOUNG ADULTS IN A MILITARY POPULATION. *Francis A. Arnold, Jr., B.S., D.D.S., H. Trendley Dean, D.D.S., and Dennis E. Singleton, Jr., D.D.S., National Institute of Health, U. S. Public Health Service, Bethesda, Md.* The efficacy of single topical application of 5000 ppm. fluoride (F) solution (pH 4.0–4.5) for dental caries prevention has been tested over a 1 year period on U. S. Coast Guard Academy Cadets. *Technical methods:* At beginning of study a complete dental examination, including intraoral radiographs and L. acidophilus counts, was made of 258 cadets. Population was divided into 2 matched, or paired, groups known as "A" and "B." For each individual placed in "A" group a comparable or matching individual was placed in "B" group on basis of following recognizable variables: past caries experience, *L. acidophilus* counts, exposure to fluoride intake first 8 years of life, and age. The same dental officer made both the original and the second clinical examination, and in the latter having no knowledge of whether the individual was in control or treated group nor of the findings of the previous year's examina-

tion. A second dental officer gave each Cadet a dental prophylaxis and applied to the teeth either solution "A" (sodium chloride—control) or solution "B" (sodium fluoride—experimental); both solutions of equal concentration and contents unknown to officer applying them. *L. acidophilus* counts were made of each individual at approximately 3 month intervals. Average age of Cadets at start was 19.6 years (range 17–23 yrs.). All ate in a common mess hall. *Findings:* of 258 Cadets (129 pairs) in original 1942 group, 188 (94 pairs) remained in study during entire year. All comparisons made on latter group. During study year treated and control groups developed about the same number of new carious teeth (controls 58, treated 64), showed similar gains in new carious surfaces or areas (controls 206, treated 213), and exhibited similar distributions of *L. acidophilus* counts. There is no suggestion from the findings of the present study to indicate that a single application of a fluoride solution of this concentration would be of value in reducing the incidence of dental caries in young adult males. (Published in *J. D. Res.*, 22: 155, 1944, this issue).

44. Effects of fluorosis on the deposition of phosphorus in bones and teeth of young rats as indicated by radioactive phosphorus. *H. B. McCauley, D.D.S., The University of Rochester School of Medicine and Dentistry, Rochester, N. Y.* Forty-eight female albino rats, approximately 37 days old, on a normal diet were given supplements of 0, 100, 200, and 300 parts per million of fluorine as NaF in the drinking water for a period of 30 days. The growth rates of the animals receiving fluorine were retarded. Not more than 200 parts per million were tolerated. Significant reductions in the water consumption were noted in the 200 and 300 parts per million groups. At the end of the fluorosing period, the animals were each given radioactive phosphorus by stomach tube, and sacrificed 24 hours after administration. Samples of blood, incisors, molars, and femurs were prepared for radio-element determinations. Decreases in the percentage of the dose per gram of inorganic tissue were obtained for the teeth and the femoral epiphyses of fluorosed animals. No significant changes occurred in the blood or diaphyses.

45. Some dietary studies on rat caries. *Harold C. Hodge, Ph.D., The University of Rochester School of Medicine and Dentistry, Rochester, N. Y.* Groups of rats were placed on the Hoppert-Webber-Caniff diet. Some of these rats were placed after 6 weeks on the Hoppert Webber-Caniff diet to which 50% powdered sugar was added. These rats were found after 200 days on the diet to have no higher incidence of cavities but much more extensive lesions than the control rats. Other groups of rats were placed on various levels of vitamin E added to the diets. There is some evidence that intermediate amounts of vitamin E are beneficial. In a cooperative study with Dr. Leonard Fosdick certain groups of rats were placed on various dietary levels of vitamin K. Although reduction in growth was observed from very high intake of vitamin K the number of dental lesions did not differ from that observed in the control rats.

46. The reestablishment of transeptal fibers following extraction. *S. W. Chase and John Revesz, Western Reserve University, Cleveland, Ohio.* Extraction of a tooth self-evidently results in extensive destruction of the tran-

septal fibers between the tooth and the approximating teeth. When deciduous second molars of macaques were extracted, new transeptal fibers were formed joining the first deciduous with the first permanent molar, and bridging the extraction space. The reorganizeed fiber-group consists of a dense band of nearly parallel collagenous fibers closely resembling the ligament-like normal transeptal fibers. Similar reorganized transeptal fibers are found also bridging the extraction spaces of human jaws. In the macaque the reorganization is completed in as little as 5 weeks and takes place in spite of the force exerted by an orthodontic appliance designed to produce continuous traction on the teeth joined by the new tissue.

47. DENTAL CARIES IN MONKEYS. *Humberto Granados, Dr. Odontol, School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Ground sections of the permanent teeth of 9 monkeys, *macacus mulata*, 3 (8 animals) and 9 (1 animal) years of age were prepared. The animals were born into captivity and fed an apparently normal diet, consisting of wheat, dog chow, whole shelled corn, soy beans, carrots, orange, spinach, and other green vegetables. No caries was observed in anterior or premolar teeth. Lesions encountered in the molar teeth were of the following types: (1) first degree smooth-surface lesions, characterized by incipient decalcification of interprismatic substance and deposition therein of a yellow-brown pigmentation; (2) enamel caries arising in grooves and fissures, distinguished by marked pigmentation and zones of intraprismatic transverse striation and accentuated striae of Retzius; (3) second degree lesions arising in grooves and fissures, spreading along to structures similar to the lamellae of human enamel and in dentin underlying continuous portions of the dentino-enamel junction; and (4) lesions involving deeper portions of dentin. The fourth type was found only in the 9 year old monkey. Since the macaques closely resemble the human being anatomically and physiologically, and because their dentition and carious lesions are strikingly similar to those found in man, it is suggested that the macacus may be particularly well-suited to dental caries investigation.

48. DENTITION OF THE SYRIAN HAMSTER. *Paul H. Keyes, D.D.S., and Peter P. Dale, D.M.D., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* The Syrian hamster, *Cricetus auratus*, now employed as a laboratory animal in the study of dental caries, has a dentition similar, but not identical to that of the albino rat, formula I1/1 M3/3. The incisors appear to be like those of the rat, but the molars are distinctly different. The most significant difference is in the *morphology* of the cusps. In the rat, they are comparatively angular and separated by deep narrow fissures, whereas in the hamster, the cusps more closely resemble the human form, with less precipitous fissures between them. Hamster molars give the impression of sharp-cusped human maxillar premolars fused together, yet separated by broad, deep sulci. Mesio-distally, deep grooves separate buccal and lingual cusps. Ground sections reveal a highly transparent enamel which completely covers the unworn crown. Enamel lamellae are more commonly found at the bottom of the sulci. The dentin is

not unlike human dentin. The root surfaces are covered by a non-cellular cementum except at the apices where a cellular type is present.

49. EXPERIMENTAL DENTAL CARIES IN THE SYRIAN HAMSTER. *Peter P. Dale, D.M.D., Paul H. Keyes, D.D.S., and Joseph P. Lazansky, M.D., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.* Groups of Syrian hamsters, *Cricetus auratus*, were maintained on various unrestricted diets for a period of 125 days beginning shortly after weaning. Rations included (I) the Hoppert-Webber-Canniff coarse corn diet; (II) a finely meshed corn meal diet; (III) a checkered rabbit chow diet; and (IV) the Hoppert-Webber-Canniff diet plus 50 parts per million of fluorine as NaF in the drinking water. Supplements of fresh apples and carrots were provided once a week for all animals. Hamsters receiving II and IV thrived to a greater degree than the others. The fluoride was well tolerated with no evidence of toxicity other than mottling of the incisors, which appeared in 8 to 10 weeks. Average caries scores observed were (I–N): 31.2, 36.5, 5.2, 5.8. The role of tooth-fracture in the production of decay in the hamster is probably of minor importance since lesions were found without evidence of fracture, were produced in animals on a finely ground cereal diet, and were observed in areas favorable for food accumulation. The yellow pigmentation characteristic of the disease in man was evident in all lesions. Typical undermining decay at the dentino-enamel junction was also observed. Caries was most prevalent in the deep grooves. A few cervical lesions were seen, and incipient interproximal lesions suggested. Animals receiving IV were less susceptible.

X. SIXTH SESSION: EVENING; MARCH 19; ABSTRACTS 50–53

50. REMARKS AS RETIRING PRESIDENT OF THE INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH. *Philip Jay, D.D.S., Sc.D., University of Michigan, Ann Arbor, Mich.* *See page 181.*

51. THE MEDICO-LEGAL ADVENTURES OF A PHYSICAL ANTHROPOLOGIST. *Wilton M. Krogman, Ph.D., University of Chicago, Ill.* Dr. Krogman's presentation was both instructive and entertaining. He began by denying the common assumption that "dead men tell no tales." Bones of the "corpus delicti" supply generously data from which may be deduced reliable, and in many instances very accurate, conclusions as to whether or not the remains are human, and as to the age, sex, race stock, height and weight of the dead body. They may also supply evidence as to whether or not the cause of death was associated with injury or trauma. Because of this, wheresoever bones are recovered under circumstances which suggest crime, violence or mystery, the door to adventure for the physical anthropologist is opened wide. But let the would-be adventurer beware, he must love adventure, he must have a stout heart and solid confidence in himself, he must realize that the pursuit of truth, even in this area, is associated with some risk, and must also appreciate that the investigation may disclose or become involved in a struggle for high stakes with competition at the highest possible level. This served as an introduction to the narration of a number of Dr. Krogman's own experiences in this field, experiences which he told robustly

and with the jaunty air of a true adventurer and as a past master of skill in expression.

52. INTRODUCTION OF NEW PRESIDENT OF THE INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH. *Thomas J. Hill, D.D.S., Western Reserve University, Cleveland, Ohio.* See page 183.

53. INAUGURAL ADDRESS. *H. Trendley Dean, D.D.S., United States Public Health Service, Bethesda, Md.* See page 183.

XI. ABSTRACTS OF PAPERS READ BY TITLE; ABSTRACTS 54–83

54. POLIOMYELITIS INDUCED BY INOCULATION OF TOOTH PULP CAVITIES. *Myron S. Aisenberg, D.D.S. and T. C. Grubb, Ph.D., School of Dentistry, University of Maryland, Baltimore, Md.* Pulp chambers of the anterior teeth of 3 macacus rhesus under nembutal anesthesia were exposed. The pulps were removed and 1 drop of 20 or 40% suspension of the "Creach" strain virus placed in each canal and the cavities sealed with "Plicene" or silver amalgam. Two animals inoculated with 20% suspension followed by silver amalgam seals failed to develop paralysis on each of two attempts. One animals, inoculated with 20% suspension followed by Plicene seal failed to develop paralysis in three weeks, but a second trial with 40% suspension and Plicene seal resulted in paralysis of all 4 legs in 8 days. Sections of the cord revealed typical poliomyelitis lesions and the Gasserian ganglion showed marked cellular infiltration, some neuronophagia and keryolysis. (Published in *J. Bact.*, 46:311, 1943.)

55. RAMPANT DENTAL CARIES: PREVENTION AND PROGNOSIS. A FIVE YEAR CLINICAL SURVEY. *Hermann Becks, M.D., D.D.S., Arthur L. Jensen, D.D.S., and Compton B. Millarr, D.D.S., Hooper Foundation for Medical Research and College of Dentistry, University of California, San Francisco, Cal.* The investigation had as its main objectives to answer the following questions: 1. Is L. acidophilus consistently present during dental caries activity; 2. Is the reduction of refined carbohydrate intake effective in reducing the L.a. index; 3. Is the reduction of a high L.a. index accompanied by a reduction of dental caries frequency? The findings may be summarized as follows: 1. Caries activity and caries inactivity were found to be accompanied by positive and negative L.a. indices respectively. In a group of 1250 rampant caries cases 1096, or 87.7%, had indices of 1000. The reverse picture was found in 265 caries-free individuals, 218, or 82.3% of whom had L.a. indices below 1000. Therefore, the presence of L.a. constitutes a significant index and establishes this index as a qualified laboratory test for the diagnosis and prognosis of dental caries. 2. In 1004 (81.7%) of 1228 rampant dental caries cases a reduction of the L.a. index was obtained within a period of a few weeks by reducing the intake of refined carbohydrates and replacing the calories derived from these foods by increasing the intake of meat, eggs, milk and milk products. This high degree of success establishes the reduction of the intake of refined carbohydrates as at least one effective means of reducing the L.a. index. 3. The reduction of the L.a. index resulted in a drastic decrease in dental caries frequency. In a group of 790 rampant caries cases the prevention of new cavities was achieved along with a reduction of

the L.a. index to the extent of 80%. Of these, 62.3% were arrested completely while an additional 17.7% developed only 1 or 2 cavities during the following year. In 665 cases with favorable L.a. response no new cavities developed in 17.7% and within the limits of 1 or 2 cavities in 88.4%. This instance of favorable response establishes the definite relationship between the reduction of the L.a. index and the reduction of dental caries activity. From the experience gained, it has become evident that a program of dental caries prevention based on L.a. indices and corrective procedures could be entirely practical and effective in private practice, institutional work and public health service.

56. ANTAGONISM OF PITUITARY ADRENOCORTICOTROPIC HORMONE (ACTH) TO THE ACTION OF GROWTH HORMONE OF THE OSSEOUS SYSTEM OF HYPOPHYSECTOMIZED RATS. *Hermann Becks, Miriam E. Simpson, Walter Marx, Choh Hao Li, and Herbert M. Evans, Hooper Foundation for Medical Research, College of Dentistry, and the Institute of Experimental Biology, University of California, Cal.* As a result of simultaneous administration of adrenocorticotropic hormone (ACTH) and growth hormone into hypophysectomized rats, the following changes in the typical effects of growth hormone on such animals were observed: The proximal epiphyseal cartilage of the tibia was greatly decreased in width and endochondral bone formation was significantly retarded. Osteoclastic as well as osteoblastic activity was greatly decreased, perhaps accounting for the irregular arrangement of bony traveculae. The cartilage columns in the erosion zone were also more irregular. The ACTH alone had the same effect on cartilage columns; otherwise the injection of ACTH into hypophysectomized rats scarcely affected the picture. The marrow was more compactly cellular, and freer of fat cells in all animals receiving the ACTH whether combined with growth hormone or not.

57. EFFECTS OF ADRENOCORTICOTROPIC HORMONE (ACTH) ON THE EPIPHYSEAL CARTILAGES IN NORMAL RATS. *Hermann Becks, Miriam E. Simpson, Choh Hao Li, and Herbert M. Evans, Hooper Foundation for Medical Research, College of Dentistry and the Institute of Experimental Biology, University of California, Cal.* The treatment of normal rats with adrenocorticotropic hormone (ACTH) resulted in a retardation in both chondrogenesis and osteogenesis in the region of the proximal epiphysis of the tibia. The reduction in width of the epiphyseal cartilage while invariable, was not so extreme as that following hypophysectomy. Furthermore, in hypophysectomized rats, osteogenesis ceased, whereas in ACTH treated rats it continued at a reduced rate. Significant food restriction resulted in a retardation of body weight gain and bone growth which was somewhat less marked than that following ACTH injection when the food consumption was approximately normal. It is evident that lessened food consumption could not explain the effects of ACTH. Growth inhibition and bone changes were not caused by ACTH in the absence of the adrenals.

58. HUMAN SALIVA. XVI. RELATIONSHIP OF TOTAL CALCIUM TO INORGANIC PHOSPHORUS OF RESTING SALIVA. *Hermann Becks, M.D., D.D.S., and W. W. Wainwright, D.D.S., M.S., Hooper Foundation for Medical Research and the College*

of Dentistry, University of California, San Francisco, Cal. Calcium and phosphorus mg. % evels were directly related in all age groups of 650 individuals examined ($r=+0.402\pm0.033$). The average ration of calcium to phosphorus was 0.36 mg. % ($o=0.12$ mg. %) with an observed range from 0.12 to 1.22 mg. %. The calcium-phosphorus ration was highest between the ages of 20 and 29 years and lowest in younger and older groups. The calcium-phosphorus product mg. % was lowest in the youngest age groups, while the mg./hr. product varied greatly and without relation to age.

59. HUMAN SALIVA. XVIII. RELATIONSHIP OF TOTAL CALCIUM AND INORGANIC PHOSPHORUS TO RATE OF FLOW OF RESTING SALIVA. *Hermann Becks, M.D., D.D.S., and W. W. Wainwright, D.D.S., M.S., Hooper Foundation for Medical Research and the College of Dentistry, University of California, San Francisco, Cal.* The mg. % calcium content in 650 individuals tended to related inversely to the rate of flow ($r=-0.156\pm0.038$). The lowest rates of flow were accompanied by the highest mg. % calcium values, while above 19 cc./hr. the calcium content remained level. The phosphorus content showed a slight inverse relationship to rate of flow ($r=-0.281\pm0.034$.) The correlation coefficients of all relationships between mg./hr. values (calcium or phosphorus or their ratio or product) and cc./hr. were extremely high; for example: total calcium mg./hr. and rate of flow, $r=+0.913\pm0.006$; inorganic phosphorus mg./hr. and rate of flow, $r=+0.810\pm0.013$; calcium-phosphorus product mg./hr. and rate of flow, $r=+0.770\pm0.016$; calcium mg./hr. and phosphorus mg./hr./$r=+0.783\pm0.016$. These high correlations resulted because of the relatively slight relation between mg. % concentration and rate of flow and the fact that the amount per time unit (mg./hr.) was greatly influenced by the amount of saliva produced (cc./hr.). The high correlation between calcium and phosphorus mg./hr. values was not due to any high correlation between the minerals but rather to the manner of calculating the mg./hr. value. This was confirmed by an exceedingly low partial correlation coefficient of calcium mg./hr. and phosphorus mg./hr. holding rate of flow constant ($r_{12.3}=+0.154\pm0.038$). The calcium-phosphorus ratio was related slightly to rate of flow ($r=+0.237\pm0.037$). The calcium-phosphorus mg. % product reflected the relationships of these constituents to rate of flow ($r=-0.223\pm0.037$).

60. TOOTH PULP CHANGES AND PAIN RELATIONSHIPS. *James L. Bradley, D.D.S., M.S.D., Dan Y. Burrill, D.D.S., M.S., Edward H. Hatton, M.D., and Muriel Hewitt, A.B., Northwestern University Dental School, Chicago, Ill.* Teeth with known histories of acute pain of the clinically hyperemic type were collected by 2 of the authors and subjected to histologic examination. These were compared with teeth collected at about the same time and in some instances from the same patient; but teeth without any pre-extraction history of pain, yet with histologic evidence of definite pulp disease. Acute pain was manifested only in those cases in this group in which the pathological changes of the pulps were acute and highly inflammatory in nature with marked leukocytic infiltrations. These reactions associated with pain were definitely circumscribed, limited usually to the pulp chamber, and related in position

to carious lesions bordering the pulp but commonly without actual gross pulp exposure. Dilated and expanded vessels were common to both groups, though more marked in pulps with chronic changes without any history of associated pain. Calcifications of a pathological type were more or less common to both groups but much more impressive in the group of teeth without histories of pain.

61. INCIPIENT ORTHODONTIC LESIONS AND THEIR TREATMENT. *Carl Breitner, M.D., D.D.S., New York, N. Y.* While improvement of orthodontic appliances may still be objective of orthodontic progress, research dealing with biomechanics seems to point a way toward their reduction or elimination. A better understanding of inherited pattern of development upon which environmental influences are superimposed promises greater success in prophylaxis and treatment of dento-facial anomalies. Causes of such anomalies are chiefly twofold: 1.) damaging environmental influences; 2.) disturbances in the developmental mechanics. Orthodontic prophylaxis has so far concentrated upon elimination of damaging environmental influences; for our present knowledge is insufficient to attempt modification of inherited pattern of development in practice. It seems, however, that great majority of disturbances of this variety is not permanent but temporary. There exist 2 developmental processes, occurring simultaneously, but independent of each other, which must be perfectly correlated in time and space in order to form a normal masticatory apparatus. In such a complicated arrangement temporary disturbances may frequently occur. While in other organs such temporary disturbances may occur but may straighten out spontaneously, it is characteristic of dentition that temporary disturbances usually become permanent through mechanical fixation. This explains great number of malocclusions in mankind, and it also points to successful self-correction of such malocclusions—elimination of any interference which hinders normal development. This should be done at an age when development is far from completion. Clinical evidence shows that, for instance, cases of Angle's Class II which exist at any age of between 8 and 10 and which certainly would persist throughout life unless interfered with, heal spontaneously if unimpeded growth of mandible is permitted through elimination of mechanical hindrances. It is evident that such measures as are advocated in this report are to be instituted during the period of accelerated growth, that is, between the ages of 5 and 11 years of age.

62. THE POSITIONING OF THE FIRST PERMANENT MOLARS AND ITS INFLUENCE ON THE DEVELOPING DENTITION. *Carl Breitner, M.D., D.D.S., New York, N. Y.* Positioning in jaws of permanent molars at time of their eruption, and their relation, upper and lower to each other, has been regarded as a determining factor in normal development of permanent dentition. First to recognize this fact was Angle who named those teeth "the key to the occlusion" and claimed that particularly upper first permanent molars always erupt in a fixed and pre-determined position in maxilla. Clinical observation led subsequent investigators to substitute for this belief of Angle's, theory that place of the eruption of first permanent molars is not at all fixed, but that it always erupts in contact with the second deciduous molar. This concept is true when limited

to fact of contact between these molars, but it implies contention that place of eruption of the first permanent molar is therefore variable in both mesial and distal direction. The first is true: e.g., if mesio-distal diameter of lower deciduous molars is reduced through caries or extraction, permanent molar will erupt in a more mesial position, but if mesio-distal diameter of the lower deciduous molars is increased through over-sized crowns or separations, the first permanent molar will not erupt in a more distal position but at the time of its eruption will push forward entire lower line of deciduous teeth and thereby assume position originally designated for it. This fact has been established in animal experimentation and has been clinically corroborated. This reluctance of first permanent molar to erupt more distally, and its consequent ability to push the entire line of teeth forward instead, has far-reaching importance. Most fascinating consequence of this ability of first permanent molar to influence already erupted teeth is that it thereby influences positioning of permanent incisors and through this degree of the future overjet and overbite.

63. STUDIES IN THE TREATMENT OF ACUTE AND CHRONIC ORAL INFECTIONS BY SOLUBLE DIAMIN-SULPH-RICIN-IODI SOLUTIONS. *Ralph Howard Brodsky, D.M.D., Sea View and Mt. Sinai Hospitals, New York, N. Y.* During the past year this solution has been used topically in the treatment of acute alveolar abscesses, chronic infections of the mouth, and in root canal therapy with good results. In an extensive tuberculous osteomyelitis of the mandible of about 1 year duration, where much destruction had already occurred, daily irrigations of this solution resulted in healing within several weeks. In vitro studies indicate a definite bacteriostatic action. Where blood agar was used, high bacteriocidal action was observed. It is a watery solution of a diamin salt of a soluble sulfa, plus iodine, combined with a detoxifying ricinoleate. Further studies in the topical and parenteral use of this drug are in progress.

64. BACTERIAL DISTRIBUTION IN INFECTED PULPS. *William A. Figg, D.D.S., Edward H. Hatton, M.D., and Muriel Hewitt, A.B., Northwestern University Dental School, Chicago, Ill.* Teeth were collected by one of us (W. A. F.) and prepared for study by staining thin sections with both ordinary and bacteria revealing stains. All teeth used for this purpose were associated with histories indicating acute pulp infections. Bacteria numerous enough to be identified by this method of study are found only in regions of the infectious process that are either clearly necrotic or in places that are partly necrotic where many of the cells have lost their affinity for stains of a differential character. The regions bordering those containing bacteria are heavily infiltrated with leukocytes and the line of separation is, in some instances, quite sharp and the transition sudden. One characteristic location for this sudden transition is at the apical foramen, with the necrotic material heavily loaded with bacteria within the canal and the region of leukocyte infiltration devoid of bacteria, at least as revealed by this examination, in the adjacent apical space.

65. HEREDITARY ECTODERMAL DYSPLASIA OF THE ANHIDROTIC TYPE—REVIEW OF THE LITERATURE AND CASE REPORT. *Sidney B. Finn, D.M.D., M.S., N. Y. State Department of Health, Albany, N. Y.* Hereditary ectodermal dysplasia of

the anhidrotic type has been studied in a white girl, age 6. She presents a characteristic picture with sparse dry hair on the scalp, absence of eyebrows, a saddle nose with dry crusted nasal mucosa, dry thin light skin with inability to perspire. X-ray examination reveals the presence of only 2 maxillary teeth in the canine region. No unerupted teeth or tooth buds are present. Alveolar processes are absent giving the appearance of edentulous senile jaws. A history reveals no other similar condition in the family. In reviewing the literature a significant difference was found in the number of teeth present in the maxilla in contrast to the mandible.

66. DISTRIBUTION OF THE ORGANIC MATRIX IN ADULT HUMAN TEETH AND ITS ROLE IN CARIES. *H. E. Frisbie, D.D.S., and James Nuckolls, D.D.S., University of California, College of Dentistry, San Francisco, Cal.* It has been demonstrated by more precise methods than heretofore employed, that an organic matrix is present in a fully calcified adult human tooth. This matrix consists, as described in a previous paper, of rod and inter-rod matrix. Recovery of this matrix is dependent upon relatively long periods of fixation and controlled decalcification. By this method, not only the normal matrix has been obtained but in carious areas a matrix with the bacterial plaque in situ demonstrating the bacterial penetration deeply within the matrix. Embedding and sectioning this material at 3 and 4 microns is precisely the same as used in handling soft tissues. The tinctorial methods used were identical with those employed in our study of the matrix in a developing tooth and the staining reactions, though definite, were less precise. Special methods for staining microorganisms were employed. From studies to date the microscopic and histo-chemical evidence indicates the possibility that early enamel caries is produced by the ingress of microorganisms which, in turn, bring about a proteolysis of the organic portions of the enamel. Cavitation may be produced either through progressive surface proteolysis, by the more rapid penetration along selected channels followed by lateral spreading at dentino-enamel junction, undermining and backward proliferation of this bacterial infiltration and proteolytic activity or fenestration of enamel accompanied by breaking out in many instances of microscopic bits of enamel.

67. TWO KINDS OF UNDERMINING ENAMEL CARIES. *B. Gottlieb, M.D., Baylor University, Dental School, Dallas, Tex.* Dental caries is produced by invasions of microorganisms into the organic matter of the tooth tissues. The resistance to invasion depends to a great degree on the amount of calcification. The Retzius incremental lines consist of layers with high calcification alternating with layers of lower calcification. Caries affects the enamel layers with lower calcification earlier while the better calcified ones resist longer (undermining enamel caries along the incremental lines). The enamel nearest the dentin is known to be softer compared with the superficial layers. Once microorganisms penetrated into these deeper layers they spread here undermining the superficial layers (diffuse undermining enamel caries). (Published in *J. D. Res.*, 22: 169, 1944, this issue.)

68. TWO KINDS OF UNDERMINING DENTIN CARIES. *B. Gottlieb, M.D., Baylor*

Unversity, Dental School, Dallas, Tex. Caries is apparently the result of action of invading proteolytic microorganisms along the protein roads of the tooth tissues. Their presence is indicated by the appearance of a yellow pigment. Acid producing microorganisms may accompany them to a varying degree. Acid producers can be located in the enamel by appearance of transverse striation, and in the dentin by shrinkage. Invading a lamella, the yellow pigmentation forms the spearhead, spreads into the dentin undermining the enamel. The enamel, being more resistant to invasion may exhibit a layer of intact tissue outside the yellow dentin (undermining dentin caries proper). If, however, the microorganisms invade the narrow roads of the prism sheaths the acid producers form the spearhead. When they reach the dentin they apparently increase in number due to better living conditions and produce enough acid to make the dentin shrink away from the enamel. If the overlaying enamel closes tightly, a vacuum is created. The circulating dental tissue fluid is here the only material which can be aspirated. It stagnates and coagulates. That offers excellent living conditions and the invasion of enamel and dentin starts from that breeding place. In the beginning dentin and enamel show a smooth borderline towards the coagulated tissue fluid and only a trace of yellow pigmentation. The formation of a necrotic cavity is the final stage. The enamel breaks and the cavity is exposed. The enamel remains long unbroken because the dissolved calcium salts are replaced by the protein bodies of the microorganisms making the enamel more resistant to acid. (Undermining dentin caries due to shrinkage.)

69. Artificial dental caries on extracted teeth. *B. Gottlieb, M.D., Baylor University, Dental School, Dallas, Tex.* Caries can be produced in some extracted teeth keeping them in saliva in the incubator for several months. The saliva has to be renewed every day. Caries can be identified by yellow pigmentation in the ground section. Keeping several teeth in one bottle we avoid acid action, to a considerable extent. Erupted teeth may develop caries; we did not succeed with impacted teeth. This, in addition to some clinical facts, suggests that some as yet unknown quality of saliva influences susceptibility and immunity to dental caries.

70 Fatty changes in tooth pulps and dentin. *Edward H. Hatton, M.D., and Hugh Wilson, A.B., M.D., Northwestern University, Chicago, Ill.* Disclosure of fat in dentinal tubules has been reported briefly by at least 5 investigators, but only one in America. In general it is concluded that fatty degeneration and fatty changes of Tomes fibres are constantly associated with caries of dentin, as well as with extensive erosion and abrasion. On this account 48 teeth with extensive caries, 12 with marked abrasion, 3 with erosion and 9 grossly normal were carefully examined for fat by well recognized methods. Marked fatty changes were found in only 5 of these 72 teeth, 3 with extensive caries of dentin, 1 with marked abrasion and 1 that was externally grossly normal. But every one of these 5 teeth had one condition in common, an extensive degenerative or inflammatory involvement of the pulp in which there was more or less necrosis with advanced fatty changes of the odontoblasts. It would seem

that these pulp changes had preceded the changes in the odontoblasts and Tomes fibres and that the change in the odontoblast was progressive beginning in the body of the cell and extending into the dentinal prolongation later. Occasional single tubules containing stainable fat were found in all carious dentin but only after involvement of the associated odontoblast. Massive fatty changes in caries, abrasion and erosion without noteworthy pulp degenerations are conspicuously absent.

71. STERILITY TESTS ON LOCAL ANESTHETIC SOLUTIONS. *Holmes T. Knighton, D.D.S., School of Medicine, University of Louisville, Louisville, Ky.* Sterility tests were performed on 250 ampules and carpules of various novocaine solutions. Technics as outlined in U. S. Pharmacopoeia (U.S.P.) (1942) by National Institute of Health (N.I.H.) (1942) and cultures at room temperature on Sabouraud's agar were used. It was found that: (1) comparatively few samples were contaminated, (2) the more simplified N.I.H. technic was as efficient as that suggested by U.S.P., (3) a monilial strain (unidentified) was detectable only at room temperature. Tests in Brewer's thioglycollate glucose medium inoculated, according to N.I.H. technic, with artificially contaminated novocaine solutions indicated that it was possible to constantly detect as few as: (a) 10 organisms per c.c. with such bacteria as *Staphylococcus aureus, Escherichia coli* and *Clostridium welchii*, (b) from 100 to 300 of *Saccharomyces cerevisiae* and the previously mentioned monilial strain (latter at room temperature), and (c) approximately 1000 of *Clostridium tetani*. Sabouraud's broth was slightly more efficient for detection of yeast and monilial strains. It is suggested that in addition to the N.I.H. technic, duplicate 0.25 c.c. amounts of novocaine solutions be inoculated to 10 to 12 c.c. of Brewer's medium and Sabouraud's broth, or some similar medium, for incubation at room temperature.

72. A LINE OF DEMARCATION BETWEEN THE DEEP LAYER OF BENT PRISMS AND THE SUPERFICIAL LAYER OF STRAIGHT PARALLEL PRISMS IN OCCLUSAL AND INCISAL ENAMEL MATRIX. *M. Land, D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y., and B. Gottlieb, M.D., College of Dentistry, Baylor University, Dallas, Tex.* The stage of prism differentiation is well adapted to the study of the course of the enamel prisms. Studies of the enamel in this stage of development show that in the thick layers of the incisal and occlusal portions of the teeth, the course of the prisms varies at different depths. In the two-thirds of the enamel adjacent to the dentin the prisms course irregularly with aisles of cross sectioned prisms alternating with longitudinally sectioned ones. The latter are always twisted, with various groups coursing in different directions. In the superficial third of such thick areas of enamel, the prisms course straight and parallel, and appear to take the same shape and course as the original pre-enamel rods. These two layers of differently coursing prisms appear to be frequently separated by a distinct line which in decalcified sections appears similar to a line of early matured enamel. The high frequency of occurrence of this demarcation line suggests a possible significance in the embryology of the enamel.

73. POSTNATAL GROWTH PATTERN OF THE FACIAL SKELETON AS MEASURED

BY VITAL INJECTIONS OF ALIZARINE RED S. *Maury Massler, D.D.S., M.S., and Isaac Schour, D.D.S., Ph.D., University of Illinois, College of Dentistry, Chicago, Ill. Methods and Materials:* Same as in abstract 14 (this issue). *Findings:* (1) Largest increment of vertical growth in face occurs at alveolar border of jaws. (2) Method of alveolar bone growth is by formation of bundle bone, same method whereby growth at sutures is accomplished. Both are result of intermittent tension forces exerted upon bone via embedded fibers. Tension in one is derived from rapidly growing and expanding brain; in other from erupting tooth. (3) Palate increases in width by intersutural growth at sagittal suture and in length by growth at anterior and posterior transverse palatal sutures. (4) Mandible does *not* grow at symphysis during postnatal life. Angle at symphysis (mental angle) remains constant from early infancy to old age. Increase in the width of mandible occurs as result of V-shaped backward growth of ramus. (5) Increase in antero-posterior length of jaws occurs by backward growth of the tuberosities of the maxillae and the posterior border of the rami of the mandible. (6) Resultant vector of growth of facial skeleton is in downward and forward direction along plane connecting center of sella turcica, erupted first permanent molar gnathion. This plane is termed Y axis of facial growth. (7) Centers where the growth of the jaws is adjusted to that of rest of facial skeleton and cranium lie at zygomatico-maxillary sutures for maxillae and in combination of head of mandibular condyle and circumtemporal complex of sutures for mandible. These growth centers are so arranged in 3 planes of space as to lie at right angles to direction of growth (Y axis). (8) Mandibular growth is integrated with and adjusted to maxillary growth by a very rapid rate (most rapid in entire facial skeleton) of endochondral bone formation at condylar head. (9) Growth at condylar head by method of endochondral bone formation is similar to growing half of epiphyseal plate of long bone, presumably in order to withstand the intermittent pressure forces of mastication and to provide for very rapid growth.

74. ACCIDENTAL DISCOVERY OF A MANDIBULAR OSTEOGENIC SARCOMA IN ITS EARLY STAGE OF DEVELOPMENT. *George A. Montelius and Peter J. Brekhus, School of Dentistry, University of Minnesota, Minneapolis, Minn.* The patient, a woman 35 years of age, came to the clinic for dental treatment. Examination disclosed absence of both lower second premolars with no history of extraction. As a routine practice, complete intraoral radiographs were taken. The radiographs disclosed no impacted premolar, but an abnormal bone picture of the alveolus of the lower left first molar. An innocent looking tumescence of the buccal and lingual alveolus was noticed, more pronounced on the buccal. No history of discomfort. Pulp tests disclosed normal pulp reaction. Repeated radiographs confirmed the abnormal bone picture. Biopsy of the buccal plate disclosed an expanding neoplasm. Diagnosis: (Dr. E. T. Bell, Dept. Pathology, Medical School, University of Minnesota)—*Beginning osteogenic sarcoma.* The case was treated accordingly. This case report is presented as an illustration of the importance of close observation in oral examinations.

75. APPLICATION OF DYNAMIC SYMMETRY TO A BIOLOGIC STUDY OF FORM. *H. L. New, Northwestern University Dental School, Chicago, Ill.* Dynamic symmetry as outlined by Hambidge offers a geometric method of determining proportionality in 3 planes of space. The thesis has been advanced by many students and investigators that a proportional relationship exists between analagous structure in the mammalian species, the same structures of identical species, and in the same individual in the course of his development. The principal of dynamic symmetry is offered as a method of confirmation of these hypotheses and a means of determination of abnormal variations from such proportional relationships if they are found to exist. This method of approach is offered as a preliminary report of an investigation testing its clinical significance.

76. CONGENITAL PARTIAL HEMIHYPERTROPHY WITH MARKED MALOCCLUSION. *Charles E. Rudolph, D.D.S., and Rudolph W. Norvold, D.D.S., M.S.D., University of Minnesota Dental School, Minneapolis, Minn.* A case of congenital partial hemihypertrophy is reported. This is the third generation with a similar disturbance and is in a family with a history of twinning. There were pronounced differences in size and in eruption dates of the teeth on the two sides of the jaw. (Published in *J. D. Res.*, 22: 133, 1944.)

77. EFFECT OF EXPERIMENTAL FRACTURE ON BONE, DENTIN AND ENAMEL. *Bernard G. Sarnat, M.D., D.D.S., M.S., and I. Schour, D.D.S., Ph.D., University of Illinois, School of Dentistry, Chicago, Ill.* This gross, radiographic and histologic study is based on 38 rats, 29 of which were subjected to unilateral and 9 to bilateral fractures of the mandible. The animals were sacrificed from 6½ hours to 158 days after operation. The effects were studied in both the living and the sacrificed animals. *Dental Changes.* The fractured tooth differs from bone by the absence of callus formation and by its limited reaction. Dental changes by contrast are chiefly passive and non-regenerative and are as follows: 1. Adult enamel reacts only mechanically and is incapable of response by inflammation or repair. Enamel matrix calcifying at time of fracture is arrested in its calcification and shows resorption. Occasionally it loses its epithelial covering, which is replaced by connective tissue or cementum; 2. Dentin shows no direct reaction but the region between fragments becomes infiltrated by cells of pulp or periodontal membrane. Larger fragments are joined by fibrous union. Odontoblasts are injured and an atypical secondary dentin is formed in pulp; 3. Pulp shows a rich and varied response ranging from necrosis to complete recovery, and including bone formation and hemopoiesis. *Bone Healing.* Stages of histologic repair of fractured rat mandible may be summarized in the following chronological order: 1. Procallus: a) Hemorrhage and initial blood clot (first few hours); b) Organization of blood clot and invasion by granulation tissue (first few days); 2. Fibrous and/or fibrocartilaginous callus (first few weeks); 3. Bony callus (first to second month) and reorganization of bone (first year). These events are in complete agreement with those occurring in the healing of other flat bones.

78. METHOD OF MEASURING POINTS IN SPACE AS RECORDED BY THE BROAD-

BENT-BOLTON CEPHALOMETRIC TECHNIQUE. *Harold Schwartz, B.S., D.D.S., M.S.* The principles of analytical geometry can be employed to extend the technique of the Broadbent-Bolton Cephalometer to the measurement of cranio-facial changes in 3 dimensional space. The procedure is as follows: Two points P_1 and P_2 which are discernible on both the frontal and lateral cephalometric roentgenograms are related by careful measurements to a Cartesian coordinate system which is marked directly upon the headplates or on tracings made therefrom. These measurements, however, are distorted due to the manner in which the skeletal landmarks are projected on to the film (orthodiagraphic projection). In order to correct the distortion and secure the true or orthogonal projection of P_1 and P_2 on the film, a special grid was devised which consists essentially of two intersecting pencils of lines superimposed on millimeter graph paper. By means of this grid, the rectangular coordinates of P_1 can be speedily ascertained. Then, using the methods of analytical geometry, the distance between P_1 and P_2 can be readily computed.

79. CORRELATION BETWEEN FORMATIVE DEFECTS IN ENAMEL AND SYSTEMIC DEBILITIES. *M. P. Sheldon, B.S., D.M.D., and M. S. Bales, B.S., D.M.D., Tufts College Dental School, Boston, Mass.* Ground sections of 95 teeth from 34 patients with detailed prenatal and postnatal medical histories were examined microscopically to determine whether microscopic defects in enamel calcification were related to occurrence of systemic ailments. In more than 70% of the cases there was a positive correlation between the time of formation of a band of definitely defective enamel and the existence of some systemic debility. In 23% of the cases there were definite defects in the enamel of patients who had no histories of systemic conditions which might have produced enamel defects; in 6% there were no enamel changes in patients who had histories of disabilities which had produced enamel changes in other patients. Deficiencies of vitamins A, C, and D, and deficiency of calcium and phosphorus seemed to be the commonest causes of defective enamel formation. Enamel defects were also noted in relation to chicken pox, measles, pneumonia, pertussis, toxemia of pregnancy, intestinal and gastric disturbance and upper respiratory infection, but in practically all instances these conditions were superimposed upon an inadequate nutritional state.

80. HUMAN SALIVA. XVII. IS THERE A SEASONAL INFLUENCE ON RATE OF FLOW AND CALCIUM AND PHOSPHORUS CONTENT OF RESTING SALIVA? *W. W. Wainwright, D.D.S., M.S., and Hermann Becks, M.D., D.D.S., Hooper Foundation for Medical Research and the College of Dentistry, University of California, San Francisco, Cal.* Salivary analyses of 650 individuals accumulated over a period of 3 years, sorted according to the month of examination, were studied for possible seasonal effects. They did not disclose any seasonal variation of rate of flow, calcium or phosphorus content of testing saliva.

81. HYPOPLASTIC TEETH AND DENTAL CARIES. *J. Staz, D.D.S., L.S.D., University of Witwatersrand, Johannesburg, South Africa.* Johannesburg Indian children, 39 out of 73, had hypoplastic teeth, ranging from a generalized condition to one involving only a single tooth. Of the latter there were only 3 instances.

The case of the hypoplasia was a dietary deficiency during development and calcification and in some instances this deficiency was aggravated by the simultaneous occurrence of acute exanthematous disease. These hypoplastic teeth were found to be less susceptible to dental caries than normal teeth, and it is concluded from this study that there is no confirmation of the belief that a tooth showing hypoplastic defects is more susceptible to dental caries than any other.

82. DENTAL CARIES IN JOHANNESBURG INDIAN CHILDREN. *J. Staz, D.D.S., L.D.S., University of the Witwatersrand, Johannesburg, South Africa.* In a group of Indian children the incidence of caries is 88.5%. The highest incidence of caries is found in those children who are living on a relatively soft diet. Children who are frequent sweet eaters are more susceptible to caries than those who only eat sweets occasionally or infrequently. Some of the children examined chew betel nut and eat other nuts. The habit of chewing betel nut seems to have no inhibitory effect on the incidence of caries, although most of the betel not chewers are also heavy eaters of sweets.

83. CALCIFIED ODONTOMES. *J. Staz, D.D.S., L.D.S., University of the Witwatersrand, Johannesburg, South Africa.* Six case of odontomes are reported and discussed. These fall into 2 groups and a classification based on this fact is proposed as follows: (1) *Laminar odontomes.* This arises as a result of an exuberant proliferation and budding of the dental lamina. Cause is unknown; it has been called heretofore compound composite odontome. (2) *Invaginated odontome.* This tumor develops as a result of an aberration or abnormality arising in a developing germ. It consists of an invagination of tissue into the developing dentin papilla, the cause unknown. In this group will be found those masses of tissue which previously had been called the complex, the geminated, the dilated and the gestant composite odontomes. The terms complex, dilated and so on can be retained to indicate various subdivisions in the final structure of invaginated odontomes, but in several cases there is no clear line of demarcation between the different varieties.

XII. NECROLOGY

HENRY WEBSTER GILLETT (1861–1943)

Dr. Gillett was a charter member of the Association and a founder of the New York Section. The first eleven volumes of the JOURNAL OF DENTAL RESEARCH contain numerous papers and discussions by him and many of which were presented originally at sessions of the New York Academy of Dentistry. His retirement from active practice of dentistry occurred soon after the formation of this Association and before the beginning of its accelerated growth and general activities.

He began the practice of dentistry at Providence, R. I., with Charles N. Brackett in 1885 and continued active there until 1900 when he moved to New York City. From 1891 through 1896 he was instructor in Operative Dentistry at Harvard and during the same period a member of the Rhode Island Board of Dental Examiners. His professional career in New York was one of very great

distinction and characterized by the highest and most conscientious devotion to the best interests of his profession and the public. He was one of the organizers of the School of Dentistry of Columbia University and Professor of Operative Dentistry. One of the founders of the New York Academy of Dentistry, he was also its first president, president of the First District Dental Society and the recipient of its award for distinguished accomplishment, the Jarvie medal.

Dr. Gillett was born June 16, 1861, in New Hampshire, of Scotch-American parents, graduated from the Dedham, Massachusetts, high school and entered the Dental School of Harvard University immediately thereafter in 1883. He graduated in dentistry with the degree D.M.D. in 1885 and in the same year married Miss Elizabeth Pay. His striking appearance and continued interest in all out door activities were life long and found their consumation in his retirement to a Connecticut farm in 1922, but without ending professional interest and productivity. He died March 12, 1943.

WILLIAM HOFFMAN GARDINER LOGAN (1873–1943)

Dr. Logan was elected to membership in this Association at the Tenth General Meeting. From that time on he was a regular attendant of the sessions and a contributor to the programs at four of the general meetings. He joined the Chicago Section very promptly and rarely missed a local meeting; very often he participated in the various activities of the section and in the discussions that pertained to his particular field. He constantly encouraged members of the staff and faculty of the Chicago College of Dental Surgery to engage in all the activities that were fostered by this Association whether of a general or local character. His restablishment of the Foundation for Dental Research assisted materially in advancing these general objectives.

He began his professional career in Chicago as an assistant of the distinguished oral surgeon, Truman Brophy in 1896, thus at the very beginning fixing on his major interest in oral surgery, an interest that persisted throughout the remainder of his life. In 1902 he became Professor of Oral Pathology at the Chicago College of Dental Surgery and in 1920 Professor of Oral Surgery and Dean, positions he filled from then till the day of his death. He was in turn president of the Chicago Dental Society, the American Dental Association and the Seventh International Dental Congress and a vice-president of the Federation Internationale Dentaire. He was instrumental in the organization of the Dental Corps of the United States Army for service in World War I and became its first head from which position he was retired when the war was over with the rank of Colonel.

Dean Logan graduated from the high school at Morrison, Ill., attended the Northern Illinois College at Fulton, Ill., and agrduated from the Chicago College of Dental Surgery in 1896. He earned the M.D. degree in 1904, was made an honorary LL.D. by Loyola University in 1926 and M.S. by the University of Michigan in 1930. In June, 1900, he married Miss Florence Brophy, and surviving both is one daughter, Mrs. Donald LaChance.

GEORGE HENRY WRIGHT (1869–1941)

Dr. Wright was a charter member of the Association and one of the founders of the Boston Section. His activities were confined to the affairs of the Boston Section of which he was one of the first Councillors. His attendance at a general meeting is only recorded once (Toronto, 1930).

He began his professional career in 1904 by teaching Histology at the Harvard Dental School and in 1909 be became Assistant in Laryngology at Harvard and later Instructor. In 1919 he was made Assistant Professor of Dentistry and Clinical Professor of Oral Medicine in 1928. He retired in 1937. He was active within the clinical areas of both medicine and dentistry and did much to bring both professions closer together.

He was born in Warwick, England, December 28, 1869, and came to Baltimore, Md., in his teens. He became a student at the Massachusetts Institute of Technology and before he completed his course he was offered a place with an electrical company to travel in Europe as their representative. He spent the next four years in Europe and South America. He became interested in dentistry as the result of the influence of Dr. William Y. Allen and studied for that profession at Harvard where he received the D.M.D. degree in 1903. He married Miss Mary Louise Watson in 1904 who with a daughter (Mrs. Lincoln Gordon), a son, J. Goddard Wright, and three grandchildren survive him.

XIII. Executive Proceedings

A. Secretary-Treasurer's Report

Saturday Morning Session, March 19, 1944

Meeting called to order by President Jay and the minutes of the Twenty-first General Meeting were submitted as printed in the June, 1943, number of the *Journal of Dental Research*. Ordered approved as printed.

M. K. Hine, T. J. Hill and V. Hurme were appointed tellers to receive and count the votes for general officers as recorded on the ballot-forms and to report at the Sunday afternoon executive session.

Secretary-treasurer reported that during the past year resignations had been received and accepted from Zelma Baker, W. M. Krogman and B. F. Miller. Two members have been lost by death, H. W. Gillett (charter member) and W. H. G. Logan.

Receipts for the year were $853.52 of which $394.00 were collected as subscriptions to the Journal of Dental Research. Expenses were 354.10 of which $113.40 was paid for debits previously approved for the operation of the 1943 general meeting. As of March 17, 1944, there was on hand in current receipts, in the bank or in U. S. securities funds as follows:

In General Fund	$560.35
In Dental Science and Dental Art Fund	435.88
In William J. Gies Fund	1,338.48

Report accepted subject to later audit with report to Council.

Report of Treasurer of Wm. J. Gies Endowment Fund for the Journal of Dental Research was read by Leuman M. Waugh and ordered filed (See page 224).

Council Activities. Between meetings the Council: (1) Selected the Drake Hotel, Chicago, Ill., and March 18 and 19, 1944, as the place and time for this, the Twenty-second General Meeting. (2) Remitted the dues assessments for members in the armed services for the current year and until six months after the close of hostilities. (3) Remitted the dues of members residing outside of the United States of America. (4) Approved a budget of $320.00 for the Secretary-treasurer for the current year. (5) Nominated candidates for the 1944-1945 general officers of the Association for the official ballot-form. (6) Approved plan to set a three months deadline before the annual meeting for the submission of nominations for membership and approved the formation of a list of consultants to advise the Council as to the qualifications of candidates. (7) Approved plan to set a closing date of about the middle of January for the submission of items for the oral program of the general meeting and for the formation of a group of advisors in specialized fields to aid the program committee.

These transactions of the Council were ordered approved.

Sunday Morning Session, March 19th

American Division. Reports of the representatives of the Association to the American Association for the Advancement of Science were received and approved. On motion the treasurer of the American Division was instructed to transfer all funds held by him in the account of this Division to the William J. Gies Endowment Fund for the Journal of Dentral Research and close this account as there is no further use for this fund which was collected to defray this Association's share of the expenses in operating a joint session sponsored by the American College of Dentists, the American Dental Association and this Association at a yearly assembly of the A. A. A. S. The next joint session, it was announced, would assemble early this fall in Cleveland, Ohio.

Sunday Afternoon Session, March 19th

The following activities and actions of the Council taken during this meeting were ordered approved: (1) Selection of list of candidates eligible for membership, 27 in all. On motion these 27 candidates were elected unanimously to membership in this Association (see list, page 229). (2) Recommended that the dues for the 1944 calendar year be set at the rate of $5.00 per member, $1.00 of which is to be set aside for general expenses and $4.00 of which is to be collected and expended for the current operation of the JOURNAL OF DENTAL RESEARCH, Volume 23, 1944. On motion this recommendation was carried unanimously. (3) Recommended an overall budget of $400 for the office of the Secretary-Treasurer, subject to final disposition by a Council mail ballot. Carried unanimously. (4) Proposed two changes in the by-laws: (a) Dues of members of the Association shall be payble to the Secretary-Treasurer directly. Bills are to be issued at a convenient date just before the first of each calendar year for the ensuing annual period. (b) Members whose dues have been remitted shall receive the JOURNAL OF DENTAL RESEARCH only if the subscription price collected from members is paid. These two proposals were tentatively approved for

final disposition at the next general meeting and the Secretary-treasurer directed to act informally in accordance with them until that time. (5) Proposed an amendment to the constitution to the effect that: Each Group may have an advisory representative in the Council, to be selected by the Group. *But if any Group has more then ten members who do not belong to Sections or other Groups, its representatives in the Council and the Board of Editors may, on approval of the Council, be entitled to the same voting privileges as the representatives of Sections.* This was approved for submission to the members for a mail vote, the result of the vote to be reported at the next general meeting. (6) Suggested the appointment of a Committee to consider proposals for the classification of membership listings. On motion the appointment of this committee was ordered. (Committee appointed: W. D. Armstrong, J. L. T. Appleton and H. J. Noyes).

The report of the Tellers announcing the results of the official ballot for the selection of the 1944–1945 officers was read and approved, for list of officers elected consult page 229.

By regular motion instructed the Council to act for the Association between meetings and especially in the selection of the time and place for the next general meeting.

A rising vote of thanks was passed in appreciation of all who had assisted in the arrangements for this meeting which was noteworthy for both the size and interest of the audiences at the scientific sessions, and the spirit of good feeling that characterized all activities.

In anticipation of President Jay's address at the Evening Session and with the favorable recommendation of the Council the appointment of a committee to effect the organization of a service agency or council on research was authorized.

The dinner was served informally in the Lantern Room of the Drake Hotel attended by 132. The evening session was under the joint auspices of Omicron Kappa Upsilon and this Association, both presidents Robert E. Blackwell and Philip Jay acting jointly for the induction of officers and the formal adjournment of the annual meetings of both organizations.

EDWARD H. HATTON, *Secretary-treasurer.*

B. REPORT OF THE PUBLICATION COMMITTEE, JOURNAL OF DENTAL RESEARCH

During 1943 the JOURNAL received 58 papers and there were 18 on hand from 1942. Of these 76 papers, 57 were published, 6 rejected and 13 were carried over for 1944. Volume 22 included 57 scientific papers and 84 abstracts in its 521 pages. Almost one-half of the total papers were contributed from 6 universities (2 of these having no undergraduate dental departments). Papers are now being published within 6 months of receipt.

The cost of publishing Volume 22 was $4846.42 ($3634.34 printing, $41.25 stationery and supplies, $95.00 postage and $1065.38 miscellaneous and clerical).

The total paid subscribers were 1831 and the press run was 2200. Up to 1940 the total paid circulation did not exceed 775, in 1941 it was 1079, in 1942 it increased to to 1349.

The Board of Editors voted that reprints of articles published in the JOURNAL OF DENTAL RESEARCH shall be sold only to authors and coauthors of each article and that no more than 500 reprints will be sold to the author, that single copies of the JOURNAL may be purchased for $1.00 and that the Publication Committee shall refer all requests for reprints or copies not in accord with these regulations to the Board of Editors for final decision.

C. WILLIAM J. GIES ENDOWMENT FUND, JOURNAL OF DENTAL RESEARCH

*Financial Statement as of March 17, 1944**

This Fund was created, on the initiative of the voluntary Committee on Endowment—organized in New York City in 1937—to insure the continuance of the Journal of Dental Research "in full accord with the highest ideals of strictly professional journalism devoted to the advancement of research," to which the Journal was dedicated at its establishment in 1919.

I. Amounts received from organizations (March 12, 1943–March 17, 1944)

†Alpha Omega Fraternity	$25.00	
American College of Dentists—Kentucky Section	170.00	
American College of Dentists—Kentucky Chapter—given by J. H. Springsted	5.00	
Atlanta (Georgia) Dental Society	25.00	
Baylor University, College of Dentistry—given by P. Knutzen, Acting Dean	15.00	
Eastman Dental Dispensary, Inc.	300.00	
International Association for Dental Research—Minnesota Section	25.00	
Nevada State Dental Association	15.00	
Ohio State Dental Society—annual payments for 1942–43	120.00	
Omicron Kappa Upsilon—Rho Chapter	200.00	
Omicron Kappa Upsilon—Xi Chapter	25.00	
Psi Omega Fraternity, Phi—Rho Chapter	10.00	
San Francisco (California) District Dental Society	25.00	$960.00

II. Amounts received from individuals (March 12, 1943–March 17, 1944)

$200: In memoriam: John and Ophelia E. Gies, Reisterstown, Maryland, 1872; (John Gies III, William J. Gies, II) Completes pledge of $1,000	200.00	
180: Arthur H. Merritt	180.00	
100: Captain James T. Gies, Captain Robert H. Gies, I. Hirschfeld, Leuman M. Waugh, and one contribution from the following group: Drs. Louis T. Austin, Edward C. Stafne, Boyd S. Gardner, Jerry A. Millhon, Stanley A. Lovestedt—all of the section of Dental Surgery, May Clinic, Rochester, Minn.	500.00	
75: R. J. Rinehart, Simon Shapiro	150.00	
25: Ernest N. Bach, John J. Fitz-Gibbon, Charles W. Freeman, H. D. Grubb, M. M. House, Malvern D. Huff, Arthur S. Litten, L. D. Pankey, Joseph E. Psayala,** Marcus L. Ward, Maurice William	275.00	

* See *J. D. Res.* **20**: 295, 1941, *J. D. Res.* **21**: 346, 1942 and *J. D. Res.* **22**: 1943 for previous reports.

† Additional contribution.

** See Sec. VI.

20: W. F. Lasby, Albert L. Midgley, Charles I. Taggart	60.00	
15: George M. Anderson, John C. Black, O. W. Brandhorst, L. C. Hemsworth, P. V. McParland, Arthur Miller, E. Milloversun, C. M. Taylor	120.00	
10: Edward L. Ball, Charles M. Barnwell, A. H. Bassman, Frank J. Bell, I. B. Bender, Paul N. Bennett, Frank E. Beube, Charles Bodecker, David W. Brock, E. H. Bruening, George C. Brown, A. W. Bryan, H. L. Bunker, E. A. Charbonnel, Oscar J. Chase, Jr., George Wood Clapp, Frank C. Cole, C. B. Coleman, J. V. Conzett, Ivan R. Cottrell, Wilbur McL. Davis, William R. Davis, Captain H. R. Delaney (D.C.) Robert L. Dement, M. M. Devan, Gerard A. Devlin, Meyer Eggnatz, Samuel S. Eisner, E. O. Ellington, R. H. Fladeland, C. O. Flagstad, Willard C. Fleming, C. G. Fletcher, Willard H. Foss, W. Talbot Foster, G. Fred Hale, T. A. Hardgrove, L. A. Harker, James F. Henegan, J. D. Hertz, W. N. Hodgkin, W. J. Hollingshead, Geneva E. Groth, John E. Gurley, Thomas J. Hill, Conrad L. Inman, James T. Ivory, Andrew F. Jackson, George B. Jersin, Ernest L. Johnson, Raymond E. Johnson, Alfred W. Kany, W. N. Kelly, Paul C. Kitchin, Albert H. Kniesner, Alfred L. Kohn, Leonard Kohn, H. O. Lineberger, W. E. Lundy, W. J. B. Mason, C. J. Masters, Fred E. Maxfield, John Oppie McCall, John F. McParland, Harry A. Mesjian, Sydney R. Miller, E. L. Mitchell, Waldo H. Mork, Emory W. Morris, L. R. Musser, Ivor P. Muzzey, Charles Nelson, Walter T. Newton, James Nuckolls, Drs. Bertha P. and Joseph T. O'Leary, J. W. Outlaw, Henry C. Petray, William R. Pond, Lowrie J. Porter, K. C. Pruden, Charles E. Rudolph, Robert Wm. Rule, Jr., Major J. B. Schneer, Clyde H. Schuyler, Benjamin Shapiro, Harry B. Shuman, W. K. Slater, Ernest G. Sloman, D. M. Small, C. M. Smith, Franklin A. Squires, H. Hayward Streett, Charles A. Sweet, R. Hamill D. Swing, W. C. Tannebring, Isidore Teich, Jerome H. Trier, E. G. Van Valey, Ralph Waldron, Leonard T. Walsh, C. R. Wells, Frederick T. West, R. C. Willett, Harry T. Wood, W. A. Wood	1,050.00	
9.45: George P. J. Pritchard Contribution was $10, less commission & service chg.	9.45	
9.28: Arthur L. Walsh Contribution was $10.60, less discount & service chg.	9.28	
5: Harry Bear, Reuben L. Blake, Frank Carothers, O. M. Davis, Joseph D. Eby, Henry C. Fixott, Hannah Frankowitz, Guy M. Harrison, A. W. Haskell, Abraham Lees, Harry Lyons, Maurice Markowitz, Leon W. Marshall, Leroy M. S. Miner, Gerald Mitchell, Edith B. Oblatt, M. Webster Prince, Jacob Shapiro, William C. Stillson, Gordon L. Teall (completes pledge of $10), J. W. Vogan, Leonard P. Wahl	110.00	
4.50: F. A. Richmond, int. on bond	4.50	
3: J. C. Curry	3.00	
2: Earl W. Pellien, E. B. Penn	4.00	
1: Zachary Blum	1.00	2,676.23
Total contributions 1943–44		$3,636.23
Total cash receipts were		$3,611.23

One contribution of $25.00 was in form of War Bond—see Sec. VI.

III. Interest Income and expense (current year)

There was no interest earned since all deposits had been withdrawn from savings accounts in April and July 1942 to purchase War Bonds	—
There were no expenses recorded	—

IV. Summary of total receipts (assets): 1937–44

Total receipts for the Fund, as of March 12, 1943		$32,732.99
Paid for 42 War Bonds	$31,080.00	
Balance on deposit	1,230.99	
Bonds and shares—contributions from members previously reported	422.00	
Receipts in 1943–44:		
From organizations (Sec. 1)		960.00
From individuals (Sec. 11)		2,676.23
		$36,369.22
Payment for 43 War Bonds (Sec. VI)	$31,820.00	
Balance on deposit	4,102.22	
Bonds and shares	447.00	

V. Cumulative summary of annual recorded items of receipts and expenditures

	Contributions (payments)	*Earned Interest*	*Expense*	*Net Receipts*	*Cumulative annual net receipts*
1937–38	$10,652.50	None	$134.06	$10,518.44	$10,518.44
1938–39	4,748.17	None	None	4,748.17	15,266.61
1939–40	5,693.78	None	None	5,693.78	20,960.39
1940–41	5,190.55	$206.78	3.53	5,393.80	26,354.19
1941–42	4,166.35	333.95	None	4,500.30	30,854.49
1942–43	1,766.31	112.19	None	1,878.50	32,732.99
1943–44	3,636.23	None	None	3,636.23	36,369.22
Totals	$35,853.89	$652.92	$137.50	$36,369.22	

VI. Statement regarding investment in War Bonds

By authorization of the Trustees of the Association, forty-three War Bonds of Series F ("12-year appreciation bonds"), costing $740 each, have been purchased from the funds in the Endowment Committee's treasury, as of the following dates and serial numbers:

Purchased (10) March 30, 1942: M140400F to M140409F, inclusive	$7,400.00
Purchased (22) May 29, 1942: M197811F to M197832F, inclusive	16,280.00
Purchased (8) July 29, 1942: M237558F to M237565F, inclusive	5,920.00
Purchased (2) December 21, 1942: M423990F and M423991F	1,480.00
Purchased (1) March 1943: M204356F	740.00
	$31,820.00

The payee named on each bond is "Committee on the William J. Gies Endowment Fund for the Journal of Dental Research (an unincorporated body)." All of these War Bonds (and the Bethany Methodist Hospital Bond and Farnsworth Television and Radio Corporation Stock, indicated in Section IV) are in the custody of the Treasurer of the Committee, in a safety deposit box, Empire Trust Company, 580 Fifth Ave., New York City, in trust for the Committee.

The contribution of $25 listed in Section II from Dr. Joseph E. Psayala was in the form of a United States Savings Bond Series F ("12-year appreciation bond") #Q631670F, the payee being "William John Gies Endowment Fund for Journal of Dental Research." It is in the custody of the Treasurer in a safety deposit box, Empire Trust Company, 580 Fifth Ave., New York City, in trust for the Committee. Purchased in February 1944.

VII. Summary of open accounts relating to pledges

A. Organizations

	Pledge	*Paid*	*Balance*	
American College of Dentists	$5,000	$4,000	$1,000	
International College of Dentists	800	200	600	
Kansas: First District Dental Society	100	25	75	
J. B. Mann Study Club, Washington, D. C.	1,000	100	900	$2,575
B. Individuals				
Harry Kaplan	250	100	150	
George C. Paffenbarger	250	235	15	
R. J. Rinehart	200	75	125	290.
				$2,865.00

LEUMAN M. WAUGH, *Treasurer,*
William J. Gies Endowment Fund for the Journal of Dental Research

D. OFFICERS AND MEMBERS ELECTED

ACTIVE OFFICERS: President—*H. Trendley Dean*, National Institute of Health. President-elect—*Wallace D. Armstrong*, University of Minnesota. Vice-president—*Samuel W. Chase*, Western Reserve University. Secretary-treasurer—*Edward H. Hatton*, Northwestern University. Trustee—*J. L. T. Appleton*, University of Pennsylvania.

MEMBERS ELECTED: Binghamton, N. Y.—*Gordon R. Winter*. Chicago, Ill.—*Joseph C. Calandra* and *Edwin N. Cooper*, Northwestern U. East Chicago, Ind.—*Joseph R. Jarabak*, Northwestern U. Indianapolis, Ind.—*Drexel A. Boyd* and *Henry M. Swenson*, Indiana U. Iowa City, Iowa.—*Ray V. Smith*, Iowa State U. Kansas City, Mo.—*Leslie L. Eisenbrandt*, Kansas City U. London, England—*Robert Weaver*, Ministry of Health. Memphis, Tenn.—*Herbert P. Steinmeyer*, U. of Tennessee. Minneapolis, Minn.—*Rudolph W. Norvold* and *Alan M. Treloar*, U. of Minnesota. Nashville, Tenn.—*M. Don Clawson*, Meharry Medical College and *Claude R. Wood*. New York, N. Y.—*Solomon N. Rosenstein*, *Lewis R. Stowe* and *Edward V. Zegarelli*, Columbia U.; *Chester J. Henschel*. Rochester, N. Y.—*Melvin Land* and *David B. Scott*, Rochester U. San Francisco, Cal.—*Harvey M. Schamp*, College of Physicians and Surgeons and *Wendell L. Wylie*, U. of California. Santiago, Chile—*Fernando Lara Brava*, Santiago Dental School. Toronto, Ontario—*Roy G. Ellis*, U. of Toronto. Washington, D. C.—*George Dickson*, National Bureau of Standards; *Victor H. Dietz*, U. S. Army Dental School; *Henry A. Swanson*, Army Medical Museum.

E. MEMBERS VOTING AT ANNUAL MEETING

Aisenberg, G. M. Anderson, B. G. Anderson, Appleton, Armstrong, Arnold, Atkinson, Baker, Bartels, Bauer, Bear, Becks, Berger, Beube, Bevelander, Bibby, Blayney, Blumen-

thal, Bodecker, Bossert, Boucher, Boulger, Brand, Breitner, Broadbent, R. K. Brown, Bryan, Bunting, Burket, Canby, Carr, Chase, Cheyne, Clough, Cohen, S. D. Collins, Cox, Coy, Crane, Crawford, Crowell, Dahlberg, Dale, Deatherage, Denton, Dobbs, W. B. Dunning, Easlick, East, Easton, L. F. Edwards, Ralph Edwards, F. C. Elliott, Elvove, Sidney Epstein, Erikson, Fairbank, Fee, Fleming, Fox, Gabel, Gafafer, Ginn, Goldman, Gottlieb, Gregory, Grossman, Hadley, Hahn, Hall, Harrison, Hayes, Hidnert, Higley, Hodge, Hoffman, Hubbell, Hughes, Hutchinson, Ivy, Jay, Jordan, Kaiser, Keilty, Kelsey, Ker, Kern, Kesel, Keys, King, Kingery, Kitchin, Klaffenbach, Kniessner, Knighton, Koch, Kotanyi, Krogh, Lalonde, Lasby, Leonard, Lewis, Lischer, Lowery, Luckhardt, Lundquist, Main, Manly, A. W. Mann, Mason, Massler, McCall, McCauley, McClendon, McClure, Merkeley, Merritt, Midgeley, Milhon, H. A. Miller, S. C. Miller, Miner, G. R. Moore, Mary Moore, A. H. Mueller, Emil Mueller, R. E. Myers, V. C. Myers, C. A. Nelson, Neuwirth, Nichols, Nuckolls, Oblatt, Oppenheim, Orban, O'Rourke, Paffenbarger, C. E. Palmer, Pfeiffer, Phillips, Podolin, Prinz, Purcell, Rabkin, Radusch, Restarski, W. M. Rogers, Romnes, Scherer, Schour, Schroff, Sedwick, Shapiro, Siegel, Nina Simmonds, Simonton, Skillen, Skinner, Sorrin, Speidel, Stafne, W. F. Swanson, W. T. Sweeney, Sweet, Tanchester, W. E. Taylor, Tenenbaum, Thoma, B. O. A. Thomas, G. E. Thompson, J. R. Thompson, Tiblier, Turner, Vallotton, Van Huysen, VanKirk, Volland, Voorhees, Wach, Wainwright, Waldron, Waugh, Weatherford, Weinmann, Wheeler, Willett, N. B. Williams, Willman, Wise, Wolfe, Yates, Zander, Ziskin. Total, 193.

F. MEMBERS IN ATTENDANCE AT ONE OR MORE SESSIONS, LISTED BY SECTIONS

Ann Arbor—Bunting, Easlik, Jay, Kerr, Moore, Peyton, Ward. *Baltimore*—Aisenberg, Hahn, Robinson. *Boston*—Bibby, Deakins, Margolis, Thompson, Volker, Zander. *Chicago*—Blackwell, Blayney, Boulger, Bradel, Brodie, Burril, Burwasser, Clark, Coolidge, Dahlberg, Denton, Fosdick, C. W. Freeman, Harrison, Hatton, Hine, Kesel, Lasater, Lundquist, Majerison, Massler, E. Mueller, F. B. Noyes, H. J. Noyes, Nylander, Orban, Pendleton, Romnes, Sarnat, Schour, Shell, Sicher, Skillen, Skinner, Stephan, Teuscher, Thompson, Tilden, Tylman, Wallace, Wassermann, Weinmann, Wessinger. *Cleveland*—Chase, Hill, Kniessner, Taylor, Wylie. *Columbus*—Edwards, Kaiser, Kitchen, Spangenburg. *Houston*—Elliott. *Indianapolis*—Crawford, Hall, Phillips, Speidel, Van Huysen. *Iowa City*—Bryan, Cheyne, Klaffenbach. *Louisville*—Knighton, O'Rourke. *Minnesota*—Armstrong, Lasby, Rudolph, Waldron. *New Orleans*—Tiblier. *New York*—Bodecker, East, Gies, Hemley, Holliday, Lefkowitz, Leonard, McCall, Newman, Shapiro, Tenenbaum, Waugh. *Philadelphia*—Appleton. *Pittsburgh*—Archer, Cox, Swanson, Wright. *Richmond*—Arnim, Bear, Coy, Fee, Vallotton. *Rochester*—Finn, Hodge, McCauley. *San Francisco*—Fleming, Sloman. *St. Louis*—Bauer, Boling Lischer, Main, Purcell, Robinson. *Toronto*—Mason. *Washington*—Arnold, Dean, Klein, Souder, Sweeney. *Not Attached to Section*—B. G. Anderson, Coleman, R. A. Dean, Gottlieb, Hampp, Manly, Molnar, T. E. Moore, Paffenbarger, Rabkin, Sognnaes, N. O. Taylor, N. B. Williams, Wise. Total, 137.